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ECA/POP/TP/89/4(2.4)

A COMPARATIVE STUDY OF INFANT AND CHILDHOOD MORTALITY AND ITS RELATIONSHIP WITH FERTILITY, CULTURAL FACTORS AND SOCIO-ECONOMIC DEVELOPMENT IN SELECTED AFRICAN COUNTRIES

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UNITED NATIONS
ECONOMIC COMMISSION FOR AFRICA

(ECA/ION/TP/89/4(2.4))
23 August 1989

ECONOMIC COMMISSION FOR AFRICA
Population Division

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I. INTRODUCTION

1.1 Main Demographic Characteristics

Since the nineteen fifties and even more so from nineteen sixties the African population has undergone tremendous changes. According to latest population projections and estimates 1/, the total population in Africa has increased from 224,075,000 in 1950 to well over 557,441,000 in 1985 and the estmate for 1989 is more than 648 million people. This apparent rapid growth of population causes concern to development policy makers, researchers and demographers.

The rapid changes in size of population reflect the situation of high levels of fertility which have remained almost constant for more than 30 odd years and yet at the same time mortality has generally experienced a gradual downward trend. Migration as a cause of population growth in the Africa region, is insignificant on the whole. These demographic indicators are presented in Table 1.

Table 1 : Estimates of population size, fertility and mortality parameters for Africa region and Northern Africa sub-region

Region/Subregion	1950	1960	1970	1980	1989
Africa Region					
Population (million)	224	281	363	481	648
CBR	48.9	48.5	46.7	45.5	44.7
TFR	6.6	6.7	6.6	6.4	6.2
CDR	27.0	23.0	19.4	16.4	14.9
IMR	187	164	140	116	106
e	38.0	42.1	46.1	49.9	51.9
Northern Africa Sub-region					
Population (million)	52	65	83	108	139
CBR	48.9	47.5	43.0	40.8	38.0
TFR	6.8	7.1	6.4	5.8	5.3
CDR	24.7	20.6	16.6	12.3	10.7
IMR	189	165	138	99	86
e	41.9	46.4	51.0	56.7	59.0

Source : UN, World Population Prospect 1988, New York.

In terms of size of population Table 1 shows that African population has almost tripled between 1950 and 1989, with increasing momentum after ninteen seventies. However the growth of population size varied considerably among the five different geographical sub-regions of the continent. For example

1/ UN, World Population Prospects 1988, New York, 1989

among countries in Northern Africa, the population increased from about 50 million in 1950 to almost 140 million by 1989. Similarly all other regions might have experienced the same huge increase of population growth within the short span of about 40 years and yet other regions in the world did not experience such rapid rate of base population growth, during comparable period 1/.

Fertility during the past 40 years has remained almost constant at its very high levels. The apparent reduction in terms of its crude birth rate (CBR) or even its total fertility rate (TFR) is still insignificant. The CBR dropped by four points only between 1950 and 1989; and TFR appears to have hardly changed from TFR of 6.6 in 1950 to 6.2 by 1989. However, some sub-regions experienced considerable fertility declines. For example, the Northern Africa sub-region had almost ten points decline in fertility measured by its CBR which reduced from about 49 to 39 births per 1000 population per year between 1950 and 1985. The average total fertility rate per woman through her childbearing period dropped from 6.8 to about 5.3 during the same period. This decline in fertility might have contributed to reduced tempo in growth of base population in the Northern sub-region.

The estimates of mortality in Africa (presented in Table 1) are still the highest among developing regions of the world. Mortality measured by average number of deaths per 1000 population per year was abnormally high in 1950. The CDR was then about 27 and even by 1989 when the level of mortality declined by about twelve points during the past 40 years it was still higher than for any other region. Similarly mortality among children and particularly infants is equally high in the region, such that by 1989 more than hundred infants died in every thousand births per year; which represented mortality decline of about 40 per cent only between 1950 and 1989. Around 1950 life expectancy at birth in Africa was about 38 years and forty years later it increased to about 52 years only. However, different sub-regions experienced significant declines in mortality. For instance, the Northern sub-region had its mortality level drop to more than half its nineteen fifties by 1989. Hence the average life expectancy at birth increased comparatively much more from about 40 to almost 60 years by 1989.

1.2 The socio-economic context

The Africa region is reported to have more land available to be developed for agriculture than other regions of the world. However, its mode of agriculture is such that it requires more land per person in order to have some amount of produce, as in Asia or Latin America 2/.

1/ : UN, Op. Cit. 1988

2/ : UN, World Population at the turn of the Century, PP. 104-113, New York 1989.

Agricultural production growth rates have declined steadily in different sub-regions, as reviewed recently by data from Food and Agriculture Organization (FAO). According to their study best results were obtained in Central and North-East Africa where the sector grew by 2.4 per cent and 1.9 per cent respectively. In North Africa, in particular, cereal production is generally more satisfactory than elsewhere 1/. These indicators are presented in Table 2 below.

Table 2: Socio-economic indices among African sub-regions

Region/Sub-region	GDP (1986) US $	Urban % (1987)	Literacy % Rate(1976)%
Africa Region	604	29.2	50 (39)
Eastern	275	20.5	63 (47)
Central	387	33.8	57 (44)
Northern	1226	43.2	44 (30)
Southern	275	30.5	63 (49)
Western	517	29.0	38 (23)

* Literary rates in brackets are for female population only.

Source : UN, Survey of Economic and Social Conditions in Africa, 1986-1987, New York 1988.

The economic situation in Africa has also steadily deteriorated in the recent past. Studies show that annual growth rate of per capita production was slightly more than 2 per cent during the nineteen sixties. This growth rate of per capita production has since declined such that it has been superseded by population growth rate. Further information in Table 2 shows that for 1986 the gross domestic product per capita was low. Within Africa, the annual per capita product GDP was even lower particularly in the sub-Sahara Africa. Nothern Africa is the only region where GDP exceeded US $ 1000. Literacy rates too are very low, especially for females in Nothern sub-region in Africa. Many people in Africa live in rural areas where settlements are scattered over large areas thereby making it difficult to provide adequate social services. Thus only Nothern Africa has more than forty percent of its population in urban areas. This low level of economic situation hampers efforts towards achieving socio-economic development and thereby improve the well-being of people.

2/ : UN, Survey of Economic and Social conditions in Africa 1986-1987, P. 39-41, E/ECA/CM.14/4/Rev.1, New York, 1988.

1.3 Aims and objectives of study

This study was undertaken as part of 1988-1989 programme of work of ECA secretariat in the field of population. This particular output on comparative study of infant and childhood mortality and its relationship with fertility, cultural factors and socio-economic development in selected countries in Northern and Western Africa. Results of research studies such as this current study are important for policy formulation and implementation because they demonstrate crucial links of development, may influence and would save to guide activities in maternity and child care services and family planning programs and strengthen norms of societies.

The major objectives for this particular study are to - (1) examine factors that influence association between child mortality and fertility (2) identify socio-economic differentials that may exist between child mortality and fertility among the countries included in the study. The results of analysis will ultimately enable governments in the region to study and assess the impact of national programmes designed to reduce high levels of child mortality and fertility as well as strengthening efforts in areas such as health, nutrition, environment and social welfare services.

This study uses data collected as part of World Fertility Survey (WFS) programme in six selected countries, these countries included in this report are Egypt, Mauritania, Morocco, Senegal, Sudan and Tunisia. The association between child mortality and fertility has been examined in order to identify the influence exerted on child mortality and fertility, by (1) length of birth interval (2) maternal education, (3) maternal age at child birth and (4) marital status of women in the countries included in this study.

II. SOURCES AND QUALITY OF DATA

2.1 Sources of Data

Sources of fertility and mortality data are usually population censuses, demographic surveys and vital registration systems 1/. The latter would provide the most reliable information about these vital events. However, apart from few countries like Egypt and Mauritius the majority of African countries do not have civil registration systems that would provide adequate fertility or mortality data.

Having this dearth of data from vital registration systems, the only sources of demographic data are population censuses and demographic surveys. Almost all countries in Africa have

1) Robert J. Lapham, et al., Collecting data for the Estimation of Fertility and Mortality Report No. 1 National Academy Press, Washington D.C. 1981.

undertaken one or several censuses and demographic surveys since the nineteen sixties. Although these are the only sources of fertility and mortality data it is important to note that these sources have serious limitations and their data on fertility and mortality are usually inadequate and incomplete in both content and coverage. Demographic data used in this study are from national fertility surveys conducted as part of the World Fertility Survey (WFS) in the six countries included in this analysis. These data have been evaluated to ascertain their quality before proceeding with analysis.

2.2 Quality of Data

The demographic data used in this study have been evaluated in order to identify types of errors that affect estimates of fertility and mortality especially infant and child mortality and to facilitate interpretation of results. The errors of content and coverage, the most common types of errors in demographic data, are caused by omission of both births and deaths of infants and young children in particular, or misreporting of dates of births or deaths, because of memory lapses, lack of experience in record-keeping and some times proxy reporting would present incorrectly some of the vital information about births and deaths.

The first approach taken to evaluate the data against some of these errors referred to, is that of applying internal consistency checks to reports about number of children everborn and number of children that survived according to age of women and their respective proximate variable characteristics. The data on average number of children everborn or children surviving are considered to be reliable if such proportions increase gradually as age of women advances. These proportions are presented in Table 3, with illustrations in Fig. 1(a) and 1(b) which are appended to this study.

Table 3: Proportions of children everborn (Pi) and children surviving (Si) by age of women

AGE	EGYPT			MAURITANIA			MOROCCO			SENEGAL			SUDAN			TUNISIA		
	Wom	Pi	Si	Wom	Pi	Si	Wom	Pi	Si	Wom	Pi	Si	Wom	Pi	Si	Wom	Pi	Si
15-19	655	0.65	0.53	467	1.05	0.89	1412	0.17	0.15	889	0.44	0.36	220	0.75	0.61	130	0.63	0.60
20-24	1598	1.81	1.49	711	2.16	1.83	1142	1.23	1.05	760	1.71	1.35	515	2.19	1.84	643	1.52	1.41
25-29	1696	3.07	2.48	657	3.73	3.05	826	2.86	2.42	670	3.39	2.55	715	3.42	2.99	722	2.88	2.58
30-34	1523	4.61	3.61	540	5.00	4.12	620	4.77	4.06	499	5.24	3.92	501	4.99	4.28	683	4.53	3.98
35-39	1329	5.79	4.38	439	5.79	4.68	636	6.08	4.99	496	5.97	4.24	589	5.91	5.00	685	5.81	5.01
40-44	1061	6.46	4.71	317	5.97	4.50	554	7.07	5.62	393	6.76	4.58	303	6.03	5.02	696	6.60	5.41
45-49	903	6.87	4.77	239	6.05	4.47	457	7.11	5.48	258	7.22	4.88	226	6.21	5.07	514	7.04	5.63

Ideally, data on average number of children everborn classified by age groups of women, are reliable if they increase as age group of women increases. Similarly data are reliable if average number of children surviving per woman increases as age group of women increases. Data presented in Table 3 above, together with their illustrations in Fig. 1(a) and 1(b) suggest that information is reliable on children everborn and children surviving reported during the surveys conducted in these countries. However, information reported is less reliable for older women because of recall-lapse, poor record keeping, cultural taboos associated with revealing survival status of children everborn especially for those children who died shortly after birth or before christening ceremonies were conducted, and differences in accuracy of information reported by proxy persons. These distortions are examplified for older women in Mauritania or Sudan, as illustration seemingly suggest.

Another method often used to assess differential reporting of fertility history data is by comparing an expected total fertility rate based on information reported by younger women aged less than 30 years and including those who are older. These estimates are based on relations expressed in equations (1) and (2).

$$TFR_1 = (P_3)/P_2 \qquad (1)$$

$$TFR_2 = P_2 (P_4/P_3)^4 \qquad (2)$$

Where P_2, P_3, and P_4 are parities of women in age groups 20 - 24, 25-29 and 30-34. The results are presented in Table 4 below.

Table 4: Estimates of total fertility rates

Country	P_2	P_3	P_4	TFR_1	TFR_2
Egypt	1.81	3.07	4.61	5.2	9.2
Mauritania	2.16	3.73	5.00	6.4	7.0
Morocco	1.23	2.86	4.77	6.7	9.5
Senegal	1.71	3.39	5.24	6.7	9.8
Sudan	2.19	3.42	4.99	5.3	9.9
Tunisia	1.52	2.88	4.53	5.5	9.3

Total fertility rates TFR_1 computed based on information about parities of women aged 20-24 and 25-29, that is based on equation (1) and total fertility rates TFR_2 based on equation (2) computed from information of parities of women aged 20-24, 25-29 and 30-34

1) K. Hill "Appraisal and ajustment methods of demographic census data" in Population Bulletin of ECWA No. 1.8, PP. 41-61, Beirut, Lebanon 1980.

reveal that fertility is quite high in the countries included in the study. Furthermore, if TFR$_1$ is less than TFR$_2$ then it is understood that reporting is correct of birth history information by older women since information by younger women is considered to be more reliable 1/. However, for Mauritania reporting by older women seems to be suspect, as revealed by earlier test.

Having ascertained reporting of number of children everborn it is essential to examine reports about child survival. This is done by computing simple index i.e. child mortality probabilities of dying before attaining ages 2,3 and 5 years. The computations rely on relations expressed in equations (3), (4)and (5) adapted for this study 2/.

$$D(i) = CD(i) / CEB(i) \qquad (3)$$

$$Q(x) = K(i)\ D(i) \qquad (4)$$

$$K(i) = a(i) + b(i)\ (P(1) / P(2) + C(i)\ (P(2) / P(3) \qquad (5)$$

Where K(i) are multipliers calculated from parity information P(1), P(2), and P (3) reported by women aged 15-19, 20-24 and 25-29 respectively. a(i), b(i) and c(i) are coefficients given according to Trussell variant of the original Brass method reproduced in Manual X. Q(x) are probabilities of child dying before reaching age X after birth. D (i) are proportions of children dead among those everborn. i is a counter refered to age group i=1, for 15-19, i=2, for 20-24 and so on 2/. The results of these computations are presented in Table 5 below.

1/ UN, Manual X, Indirect Techniques for Demographic Estimation, PP. 76-78, New York 1983.

2) UN, Ibidem.

Table 5: Estimates of probability of child dying Q(x) before attaning age X base on proportions of children ever born and dead

Parameter	Egypt	Mauritania	Morocco	Senegal	Sudan	Tunisia
Q(2)	156.5	123.3	155.9	199.5	141.9	62.7
Q(3)	187.2	180.4	158.9	250.2	119.6	104.8
Q(5)	221.6	186.4	154.1	260.8	140.6	128.4

Differential reporting of number of children everborn and those that died, is significant if estimates of Q(2) Q(3) and Q(5) are not in an increasing order. If this were the pattern, then data on children everborn and surviving are considered reliable for Egypt, Mauritania, Senegal and Tunisia. Demographic data from Morocco and Sudan are less accurate as revealed by other studies which show serious age heaping in both countries 1/. Estimates of Q(2) Q(3) and Q(5) presented above also suggest that levels of mortality are quite high in those countries.

Despite these errors those data are fairly reliable and would be used to analyse interrelationships that exist between child mortality, fertility, cultural factors and socio-economic variables among these countries.

III MEASUREMENT AND ANALYSIS

In analysing mortality and fertility the selection of methods to be applied depends upon the quality and type of available data. The principal data used are the number of children everborn and children surviving classified by various categories of women including their current ages, level of education attained, lengths of live birth intervals and current marital status.

1/ UN, A Comparatives Evaluations of Data quality in thirty-eight World Fertility Surveys, PP. 283-285 and PP 389-391, New York, 1987.

ECA, "Mortality levels, Patterns Trends and Differentials in Africa" in African Population Studies Series No. 8. PP. 95-112, Addis Ababa 1985.

3.1 Methods of analysis

The development of demographic techniques has advanced in the recent past that it is possible to undertake complex demographic analysis from less complete birth history information collected in population censuses and demographic surveys. Two of such demographic techniques have been used in this study; and both are in the recently developed MORTPAK-Lite software 1/.

3.1 (a) FERTCB 2/

According to Mortpak software, this procedure is used to estimate age-specific fertility rates (ASFR) hence their implied total fertility rate, from data on children everborn classified by age of mother at time of survey.

Available literature reveal that under conditions of constant fertility, ASFR can be calculated from parity data by applying equation (6) below:

$$f_x = CEB_{x+1} - CEB_x \quad \text{(6)}$$

where f(x) is fertility rate for women in age group (x,x+1), and CEB_x is reported average number of children everborn for women at exact age x.

This procedure was used to generate estimates of TFR from data on children everborn tabulated by age of women reported in the fertility surveys conducted in these six countries. However, the package only accepts data that are recorded according to its procedure of data input. The estimates of TFR are presented in Table 6 with illustrations of age pattern of fertility in Fig.2 of appendix.

1/ : UN, Mortpak-Lite, the United Nations Software Package for Mortality measurement, New York 1988
- Step by step guide to the Estimation of Child Mortality - Q5 - (Press).

2/ : Adapted from MORTPAK Software Package of United Nations.

Table 6: Estimates of Age specific fertility rates (ASFR) and Total fertility rates (TFR) based FERTCB.

AGE	EGYPT	MAURITANIA	MOROCCO	SENEGAL	SUDAN	TUNISIA
15-19	0.2723	0.3820	0.1139	0.2135	0.3213	0.2442
20-24	0.1966	0.1748	0.2832	0.2770	0.2248	0.1671
25-29	0.3050	0.3489	0.3692	0.3901	0.2988	0.3408
30-34	0.2758	0.1653	0.3391	0.2663	0.2695	0.2868
35-39	0.1923	0.1531	0.2061	0.1010	0.0918	0.2255
40-44	0.1067	0.0665	0.1365	0.0944	0.0197	0.1301
45-49	0.0387	0.0244	0.0489	0.0344	0.0073	0.0467
TFR	6.94	6.58	7.48	6.88	6.17	7.21
$\bar{m}$	26.73	24.83	28.46	26.38	24.71	27.55

The estimates of ASFR and TFR reveal that fertility levels are quite high among these countries. Childbearing is concentrated in the 25-29 age group as it can be deduced from the values of mean age ($\bar{m}$) of childbearing. This observation is further illustrated in graphs presented in Fig.2. Generally, the age patterns of fertility are broad with their peaks showing around 25-29 age group.

3.1 (b) Q - five (Q5) 1/

The Q(5) is a summary index which reflects levels of mortality in childhood. This index is chosen as indicator of mortality because in high mortality developing countries there are more deaths between ages one and five than in the first year of life. It is not sensitive to mortality pattern of model selected. Hence programmes designed to reduce levels of mortality would invariably focus attention on this child population.

In developing this procedure, cognisance was that high mortality developing countries lack reliable data for mortality estimation because almost all of them have not established civil registration systems that would provide these

data. However, most developing countries have census or demographic survey data on birth histories. It is this information on children everborn and children surviving classified by age of women that is used to compute child mortality by applying the Q5 procedure.

The Q5 procedure was developed on the basis of the original Brass method. The same relations expressed in equations 3, 4 and 5 represented already were used to generate estimates of Q(5) which are presented in Table 7, with illustration in Fig. 3.

Estimates generated from this procedure should be interpreted with caution. The important factor is that this procedure derives probabilities of child deaths indirectly from reports about number of children everborn and surviving, the assumption that the model life table selected conforms to mortality pattern of the study population, that required data should be according to its format of input data, and that input data are not affected by errors associated with demographic data from developing countries. The input data were evaluated to be reliable.

Table 7: Estimates of Q5 by age based on South Model of the Coale-Demeny

Age	Egypt	Mauritania	Morocco	Senegal	Sudan	Tunisia
15-19	95	000	122	136	105	000
20-24	120	99	120	147	111	56
25-29	128	124	112	161	91	83
30-34	137	120	104	155	98	92
35-39	144	124	115	165	101	98
40-44	150	144	121	172	103	114
45-49	156	142	125	163	105	117

000 value of Q5 denotes value above a level 25 Model Life Table.

The estimates in Table 7 suggest that child mortality is still relatively high amongst these countries. However, for almost all age groups child mortality is probably lowest in Tunisia and highest in Senegal. All other countries are in the intermediate range of the two extremes. These apparent differences in child mortality between the countries may be due to differences in the level of socio-economic development, the different disease patterns or perhaps differences in cultural traditions pertaining to child values, nutrition and utilization of health facilities. Illustrations in Fig. 3 emphasize that patterns are almost parallel and quite high as from age group 20-24 onward. A more detailed analysis of factors influencing child mortality among different countries is the subject of part IV of this study.

1/ : Adapted from MARTPAK - United Nations Software Package.

IV. DETERMINANTS OF CHILD MORTALITY

Demographic studies that endeavour to research on socio-economic factors and demographic interactions are vital since they throw light on development programmes designed to improve the quality of life of the people. For instance lower mortality rates are found in countries where large proportions of people are literate and education attainment is high because there is great possibility that these countries would be able to provide socio-economic development benefits like clinics, hospitals, immunization, sanitation and clear water supply systems, and that education is understood as an indication of presence of these facilities. Furthermore, education gives women power and confidence to make decisions about chilbearing and childrearing in their families.

Early and universal marriage, frequency of re-marriages and type of marriage and marital status all influence levels of fertility and child survival. The cultural traditions among countries understudy are such that they favour early and universal marriages. In societies that practice early and universal marriage, childbearing starts very early and by the time a woman reached her menopause she would have had a large number of children. Such societies do not practice contraception, their live birth intervals are short, the value of children is high and most invariably chances of child survival are very poor. The Hutterite women for example, do not use contraceptives, marry early thus spending a very long time exposed to childbearing thus their completed family size is large 1/.

In this part of the paper the influence of cultural and socio-economic factors on demographic characteristics of fertility and mortality have been examined. The major factors analysed are marital status and birth intervals as well as maternal age. The index of analysis used is the Q5 to signify early child mortality in order to examine influence exerted on it by these various determinants in the countries understudy. The first to be interpreted is relation of marital status and child mortality.

4.1 Marital Status and Child Mortality

Marital status is one of the socio-demographic variables recognized universally by all cultures of the world. There are four kinds of marital statuses through which individuals are categorized; and these are namely single or never-married, married, widowed and divorced. Sometimes a fifth catogory is added i.e. the group of women who are separated which describes married couples who live apart 1/. Table 8 below presents percentage disribution of persons enumerated classified by their marital status.

1/ Shryock and Siegel, The Methods and Materials of Demography, Vol. 2 p. 514, U.S. Department of Commerce, Bureau of the Census, Washington, 1973.

Table 8: Percentage Distribution of Women classified by marital status

Country	Married	Widowed	Divorced	Separated	Single	Total
Egypt	83.6	7.3	8.3	0.9	-	100.0
Mauritania	63.2	5.8	30.9	0.1	-	100.0
Morocco	54.5	4.4	11.8	0.2	29.1	100.0
Senegal	62.3	7.8	17.1	0.2	12.6	100.0
Sudan	82.6	5.7	11.3	0.4	-	100.0
Tunisia	91.8	3.7	4.0	0.6	-	100.0

Information presentated in Table 8 suggests that the majority of women interviewed were married, one-tenth of them were divorced and relatively fewer women were widowed. However, there are no details to reveal the proportion of women who were either widowed or divorced and then re-married. The table also indicates that only three major marital status categories are prominent and these are married, widowed and divorced; hence only these have been adapted in this study.

In analysing the influence of marital status on child mortality or fertility it is considered that persons who are married represent stability such that they will have lower levels of child mortality, more children and more privilages to facilitate better child care than those who are widowed or divorced. Table 9 presents estimates of Q5 according to age of women and their marital status for each of the countries in the study.

1/ Bogue D. Principles of Demography PP. 312-320, John Wiley and Sons, New York 1969.

Table 9: Estimates of Q5 classified by age and marital status of women

Age	Egypt	Mauritania	Morocco	Senegal	Sudan	Tunisia
Married						
15-19	141	52	102	196	138	-
20-24	179	179	157	230	196	65
25-29	205	168	154	275	116	111
30-34	217	182	157	256	134	118
35-39	227	183	162	281	136	142
40-44	242	216	180	301	138	173
45-49	257	204	192	274	141	184
Widowed						
15-19	-	-	-	-	-	-
20-24	408	189	53	446	-	-
25-29	242	239	171	295	126	-
30-34	231	264	162	268	104	-
35-39	228	201	333	275	150	-
40-44	226	240	241	304	109	-
45-49	237	233	214	285	178	-
Divorced						
15-19	365	-	-	286	-	-
20-24	315	190	148	260	315	329
25-29	267	259	193	245	170	212
30-34	284	171	184	285	173	190
35-39	256	218	227	282	194	159
40-44	326	261	241	286	218	216
45-49	314	257	258	274	157	147

The estimates of Q5 presented in Table 9 with illustration in Fig. 4 suggest that child mortality for those who were married was lower than the divorced or widowed in all the countries. As a determinant of child mortality it is apparently clear that marital status is an important social factor that influences demographic processes. Data were not available for widowed in Tunisia, however a semilar pattern of child mortality by marital status as in the other countries is expected to prevail.

4.2 Length of Birth Interval and child mortality

There is a cultural tradition that requires women in Africa to breastfeed their children for quite some time. In most cases breastfeeding period is associated with length of birth interval since breastfeeding is used as a contraceptive method in the absence of knowledge of use of modern contraceptive methods. The period of breastfeeding as implied from median birth intervals is more than twenty-four months in countries included in this study. The median birth intervals were computed by utilizing the relationship expressed in equation (8) below.

$$MBI = lmd + \left[\frac{(W/2 - Wx)}{Wmd} \right] i \qquad (8)$$

where MBI is the Median Birth Interval computed lmd is the lower limit of class containing half the number of total women in survey W is total number of women interviewed in the survey.

Wx is the sum of number of women preceeding the class containing 1/2 W, Wmd is the number of women in the class containing 1/2 W, i is the class interval length.

The results of computation of median birth interval length are presented in Table 10 below.

Table 10: Estimation of Median Birth Intervals for Countries included in Study

Country	Parameters					
	lmd	1/2W	Wx	Wmd	i	MIB (months)
EGYPT	24	50	26.9	31.6	11	32.0
MAURITANIA	24	50	26.9	33.2	11	31.8
MOROCCO	24	50	29.6	33.5	11	30.7
SENEGAL	24	50	16.8	44.1	11	32.3
SUDAN	24	50	24.3	34.7	11	32.1
TUNISIA	24	50	32.1	31.5	11	30.3

Culturally women in Africa breastfeed for considerable time period the lengths of their median birth intervals are more than two and half years as suggested by results of computations presented in Table 10. The long median birth intervals for Senegal, Sudan and Mauritania may be influenced by the cultural traditions regarding breastfeeding and interruption of sexual abstinence since most women in these countries do not practice modern use of contraceptives. The length of median birth intervals for the other countries is contributed by wide use of modern contraception. A recent study showed that a considerable proportion of women in Tunisia, Egypt or Morocco rely heavely on modern contraceptives in reducing childbearing or lengthening periods of birth intervals 1/.

1/ UN, Levels and Trends of Contraceptive Use as assessed in 1988, PP. 6-10, New York, 1989.

Usually the pattern of childbearing affects child survival by the length of birth intervals, by maternal age and child rearing practives. Children born within closely spaced birth intervals have much lower chances of survival than otherwise. Similarly children born to younger and much older women have poorer chances of survival than those born to women in the middle childbearing age groups. The effect of diminishing resources of food and child care per head as number of dependent children increases, the chances of survival of younger children are much more empeded.

In analysing the effect of length of birth intervals on child mortality it is important to note that data may be affected by reporting errors. Birth history information is affected by cultural taboos, refusal to report number of children who die soon after birth, memory lapses about the period between live births and proxy reporting about children's births and deaths to women in the household. Other problems arise from the definition of birth intervals. If it is the length of period between consecutive live births, ignoring feotal loss (birth intervals), between consecutive pregnancy terminations (pregnancy intervals) or between one pregnancy termination and the next conception (pregnancy-to-conception intervals) 1/ then data quality is dependent upon the respondant's understanding of the interval length.

In examining the effect of length of birth interval on child mortality, birth interval length is understood to imply the period between live births. Normally chances of child survival are affected if the birth interval length is very short, that is where births are closely spaced. Five categories of birth interval lengths of a maximum of 12 months have been utilized to examine their influence on child mortality. The estimates of 5q0 classified by each category of birth interval are presented in Table 11 with illustration in Fig. 5.

1/ : Cleland and Sather, "The effect if Birth Spacing on Childhood Mortality in Pakistan" in Population Studies, Vol. 38, No. 3, PP. 401-418, London, 1984.

Table 11: Estimates of Q5 classified by age of women and [illegible]

Length Birth Interval (Months)	EGYPT	MAURITANIA	MOROCCO	SENEGAL	SUDAN	TUNISIA
<12 months						
15-19		-	-	-	-	31
20-24		220	100	352	152	127
25-29		271	241	430	128	187
30-34		199	120	363	229	57
35-39		249	192	350	193	229
40-44		206	258	342	156	249
45-49		325	227	450	52	250
12-23 (Months)						
15-19	-	-	-	-	-	-
20-24	139	126	122	185	168	43
25-29	252	201	178	330	117	117
30-34	251	199	197	332	172	159
35-39	295	235	243	366	225	167
40-44	300	262	257	379	161	187
45-49	324	268	242	330	195	195
24-35 (Months)						
15-19	-	-	-	-	-	71
20-24	109	86	137	165	89	70
25-29	158	177	144	233	122	82
30-34	231	230	140	277	142	113
35-39	251	207	143	287	148	118
40-44	284	265	179	285	144	158
45-49	284	238	170	303	166	164
36-47 (Months)						
15-19		-	-	-	-	80
20-24		100	66	107	113	69
25-29		197	132	288	102	93
30-34		136	173	228	131	108
35-39		169	176	316	126	80
40-44		254	177	331	149	128
45-49		230	202	313	167	173
48+ (Months)						
15-19		-	-		-	102
20-24		99	-		136	63
25-29		190	151		134	55
30-34		155	145		121	85
35-39		177	180		123	100
40-44		203	181		171	146
45-49		196	210		119	143

Estimates of child mortality presented in Table 11 suggest several factors to explain child mortality. Firstly, child mortality increases as age of women advances for all lengths of birth intervals being examined. This pattern is expected because older women will tend to have more children and that their children have longer exposure to mortality risks. Secondly, the length of birth interval affects child mortality in a much more complex form. Nonetheless, on the basis of estimates in this table it is apparent that shorter birth interval of less than 12 months for instance, is associated with higher estimates of child mortality than if the birth interval was longer than this. Further more, too long birth intervals are similarly associated with higher child mortality. It appears that optimal birth interval length should be about 24 months or so.

The patterns of child mortality and birth intervals for different age groups of women are illustrated in Fig. 5. It is apparent that the same observations are strengthened by these graphs. For instance if the graph for Egypt is excluded all other graphs suggest that child mortality curve is higher for birth interval of less than 12 months than all others.

Earlier, estimates of median birth intervals were computed for each of the six countries. Although, the median value has limitation of interpretation of data that are highly skewed, nonetheless it is a measure of central tendancy indicating that at least half of all women in childbearing age groups have birth intervals of between 30 and 33 months in each of the six countries. All these median birth intervals fall in the category of birth interval 24-35 months.

In examining the effect of birth intervals compounded with maternal age on child mortality it is assumed that the class of birth interval into which the median value falls is considered to be a reference interval for all age groups. Thus the values of Q5 are set equal to 100, and all other estimates by age and birth interval category are computed and presented in Table 12.

Table 12: Estimates of indixes of Q5 for Birth Interval 24-35 as base index by age of women and length of birth intervals

	AGE	< 12	12-23	24-35	36-47	48 +
EGYPT	15-19		-	100		
	20-24		128	100		
	25-29		159	100		
	30-34		109	100		
	35-39		118	100		
	40-44		106	100		
	45-49		114	100		
MAURITANIA	15-19				-	-
	25-29	256	147	100	116	115
	30-34	86	86	100	59	67
	35-39	120	114	100	82	86
	40-44	78	99	100	96	77
	45-49	137	113	100	97	82
MOROCCO	15-19			100		
	20-24	73	89	100	48	-
	25-29	167	134	100	92	105
	30-34	86	141	100	124	104
	35-39	134	170	100	123	126
	40-44	144	144	100	99	101
	45-49	134	142	100	119	124
SENEGAL	15-19	-	-	100	-	-
	20-24	213	112	100	65	-
	25-29	185	142	100	98	-
	30-34	131	120	100	82	-
	35-39	128	128	100	110	-
	40-44	120	133	100	116	-
	45-49	149	109	100	103	-
SUDAN	15-19		1	100		
	20-24	171	189	100	127	152
	25-29	105	90	100	84	110
	30-34	161	121	100	92	85
	35-39	130	152	100	85	83
	40-44	108	112	100	103	119
	45-49	31	117	100	101	72
TUNISIA	15-19	44	-	100	133	144
	20-24	181	61	100	99	90
	25-29	228	143	100	113	67
	30-34	50	141	100	96	75
	35-39	194	142	100	68	85
	40-44	158	116	100	81	92
	45-49	152	119	100	105	87

If the assumption holds that the class interval containing the median value is the base for interpreting mortality patterns the estimates suggest intersting results. For instance in Egypt child mortality is higher for birth intervals of less than 24 months for all age groups. In Mauritania child mortality is more than twice if birth interval is less than 12 months, it is about 50 per cent greater if birth interval is between 12 and 23 months, almost 16 and 15 per cent greater respectively for birth intervals 36-47 months and more than 48 months for all women in the age groups 20-24 years at time of survey. A slightly similar pattern is suggested for Senegal, Sudan and Morocco but for women aged 25-29 years at time of survey for the latter country. For all other ages in each of the countries, child mortality is higher for shorter birth intervals of less than 12 months and intervals of 12 to 23 months than the class containing the median birth interval values, that is the class interval 24-35 months. Similar comparison for birth intervals of 36 to 47 months and 48 or more months is affected by the fact that the data appear to be erratic and therefore unreliable. However the inferrence is that birth intervals longer than 36 months are associated with higher child mortality than otherwise. The following part examines influence of birth intervals on fertility.

4.3 Length of Birth Intervals and Fertility

In examining relationship between child mortality and length of birth interval it was observed that short birth intervals of less than two years and especially those of less than 12 months are particularly associated with high child mortality. A similar pattern appears to exist for very long birth intervals of more than three years. It has been suggested that both biological and physiological factors particularly of the mother combined with birth spacing all affect chances of child survival 1/. It is expected that length of birth interval has similar influence exerted on fertility.

Fertility level in this study is understood in terms of total fertility rate (TFR) which is the index of fertility being the average number of children that would be born alive to a woman during her lifetime if she were to pass through all her childbearing years conforming to the age specific rates of a given year 2/. It is expected that in high fertility countries such as those in Africa TFR is very large and in most instances it is greater than five hence women in those countries may have close birth intervals. These estimates of TFR classified by lengths of birth intervals are presented in Table 13.

1/ : UN "Interrelationships between Child Survival and Fertility" in Population Bulletin of the United Nations Nos 25-1988 PP. 27-47, New York, 1988.

2/ : Arthur Haupt and Thomas Kane, Population Reference Bureau Population Handbook, International Edition, PP. 27-31 Washington D.C. 1982.

Table 13: Estimates of TFR classified by length of Birth Intervals for countries included in the study

Birth Interval (Months)	EGYPT	MAURITANIA	MOROCCO	SENEGAL	SUDAN	TUNISIA
< 12	-	10.14	9.95	8.81	7.53	7.93
12-23	8.23	8.55	8.80	10.32	7.84	8.92
24-35	8.65	7.85	8.71	8.83	7.43	7.79
36-47	-	8.33	-	8.15	9.02	-
48+	-	-	-	-	6.41	6.75
Median Birth Interval (Months)	32.0	31.8	30.7	32.3	32.1	30.3

In addition to estimates of TFR Table 13 also presentes median length of birth intervals for each of the countries. The median length ranges from 30.3 to 32.3 months suggesting that average birth interval length for women in these countries is just about two years and half. In other words, if the class containing the median birth interval is used as the reference, then birth interval which is less or greater than this class should be associated with greater values of TFR, or high fertility.

Where data were available for all birth intervals, the TFR for shorter birth intervals of less than 12 months and those between 12 and 23 months have total fertility rates which are greater than those for the birth interval of 24 to 35 months. It is possible to deduce that longer birth intervals of 36 to 47 or 48 plus months are associated with higher fertility according to data for Mauritania or Sudan.

Another measure of fertility was needed to analyse influence of longer birth interval lenoths on childbearing. This index is the completed family size or fertility rate. This completed fertility rate is the number of children actually born per woman in a cohort of women at the end of their childbearing years. Normally women who are in the 45-49 years or 50 years or older are considered to have completed their childbearing. As a cohort measure of fertility the P(7) or average parity of women in age group 45-49 were computed and presented in Table 14 below.

Table 14: Estimates of F(7) classified by length of Birth Intervals

Birth Interval (Months)	EGYPT	MAURITANIA	MOROCCO	SENEGAL	SUDAN	TUNISIA
< 12	8.8	9.3	7.7	4.0	5.8	8.8
12-23	7.7	7.1	8.4	8.1	7.4	7.8
24-35	7.5	7.0	7.8	7.9	7.5	7.6
36-47	7.3	6.2	8.4	7.7	6.4	7.7
48+	6.8	5.9	7.7	7.0	6.2	6.6
Median Birth Interval (Months)	32.0	31.8	30.7	32.3	32.1	30.3

Since the birth interval class 24-35 months contains the median lengths of birth interval in all the countries this class was considered as containing the reference estimates of completed fertility rates. The data in Table 14 suggest a pattern of fertility that is different from that of child mortality. Here shorter birth intervals of less than 12 months and those of 12 to 23 months are clearly associated with very high fertility. Longer birth intervals are linked to reduced fertility relative to median birth intervals except in Morocco and perhaps in Tunisia. However, this association may not be strong because of doubts about reliability of quality of data for older women. The association between marital status and fertility is examined in section that follows.

4.4 Marital Status and Fertility

Childbearing in most societies is governed most invariably by the cultural traditions. In African societies and particularly those in muslim cultural traditions childbearing is recognized only among persons who are married 1/. In countries with Arab culture a similar tradition is observed. Thus in analysing fertility bahaviour in countries included in this study marital status becomes a very important variable. Normally women who are currently married and sometimes those who are ever-married are expected to be responsible for all childbearing in societies. Persons who are considered ever-married include those whore are currently married, those who are divorced or widowed. Persons who are never married are considered to be single and are not expected to have children of their own. Hence birth history information was not collected from single women in

1/ : Abdel Omran (ed.) "Islam & Fertility Control" in Egypt Population Problems and Prospects PP. 165-180, Chapel Hills North Carolina, 1973.

Egypt fertility survey conducted under auspices of WFS;as well as similar surveys conducted in Mauritania, Sudan and Tunisia. Only Senegal and Morocco of these countries collected birth history information from all women aged 15 years and over. Despite this apparent loss of information the contribution of illigitimate fertility to marital fertility is considered to be insignificant among these countries 1/.

In order to examine the influence of different kinds of marital status on fertility estimates of TFR were prepared and these are presented in Table 15 below. Normally women who are currently married have higher fertility than those who are divorced or widowed.

Table 15: Estimates of TFR classified by marital status for countries included in the study

Marital Status	Egypt	Mauritania	Morocco	Senegal	Sudan	Tunisia
Married	7.32	7.26	8.33	7.70	6.86	7.35
Divorced	5.01	5.68	6.57	5.77	4.29	5.58
Widowed	5.88	5.37	6.53	6.08	5.26	-

Estimates of TFR presented in Table 15 have interesting results for interpretation. Generally for married women the TFR are greater than for those who are widowed or divorced. However estimates of TFR for widowed women are closer to those who were currently married. It may be that women were widowed after almost completing their childbearing or that sampling fluctuations contributed to this result. Women who were divorced have the lowest estimate of TFR. Normally in societies where they cherish childbearing women who are less fertile tend to be divorced. In Egypt for example, marriage is the norm and children are visible symbols of male virility and female fertility and both are highly valued in that and similar societies 2/.

1/ ISI, Dynamic Data Base catalogue of survey data files, Voorburg Netherlands, 1987.

2/ Abdel Omran, "The Fertility Profile" inEgypt Population Problems and Prospects.PP. 102-110, University of North Carolina at Chapel Hill, 1975.

It is clear from illustrations in Fig. 5 that women who were currently married were responsible for almost all childbearing in all these countries. It is these women who had the largest number of children everborn to each woman throughout her childbearing ages. In only one country the fertility levels were similar for divorced and widowed women and this was in Morocco; otherwise fertility of widowed women is generally higher than for divorced. Comparable data for Tunisia were not at all available.

The pattern of fertility according to marital status has also been examined by utilizing the completed fertility rate, that is the average parity of women aged 45-49, which is P(7). The estimates of P(7) are presented in Table 16 below, with its illustrations in Fig. 6.

Table 16: Estimates of completed fertility rates, P(7), classified by marital status for countries included in the study

Marital Status	Egypt	mauritania	Morocco	Senegal	Sudan	Tunisia
Married	7.3	6.5	8.1	8.0	6.7	7.3
Divorced	5.2	5.5	5.3	5.7	3.3	5.6
Widowed	6.1	6.3	5.8	6.5	5.9	6.0

Estimates presented in Table 16 also suggest that married women had highest fertility followed by women who were widowed and divorced who had the lowest level of fertility in each country.

The data in Tables 15 and 16 enable us to analyse in full patterns of fertility according to marital status in all the countries. The estimates of TFR and completed fertility rates again show that married women had the highest estimates of average parity for all types of marital status in all the six countries in this study. Furthermore, estimates from Morocco and to some extent Senegal suggest that married women in these countries had the highest number of completed family size than in all other countries. Again, as observed already, estimates in this table suggest higher fertility for widowed than divorced women in all the countries.

The illustrations in Fig. 5 and 6 further complement observations from estimates presented in Table 15 and 16. In fact completed family size is highest for married followed by the widowed and divorced respectively. Perhaps the cultural values about divorce and re-married women coupled with sampling fluctuation may explain the observed situation.

4.5 Child Mortality and Fertility

The relationship between fertility and child mortality is a complex one. Some empirical studies have suggested that experience with or fear of child mortality may lead people to have additional births in order either to replace those children who have actually died or as insurance against expected deaths. Furthermore the relationships between child mortality and fertility is in both ways.If child survival chances are improved, people may be influenced to limit their family sizes hence they would seek appropriate methods for fertility control 1/.

In examining this complex relationship, the analysis strategy is to consider child loss experience and level of fertility measured by average number of children everborn in consideration of influence from factors like length of birth interval, education and age of the mother. These have been used to examine their influence on child mortality and fertility inter-relationships starting with education of mother.

(a) Education

Education of mother is influential on both fertility and especially child mortality because it improves women's access to all resources of society, it provides women with knowledge and skills of childbearing and child care. Education, furthermore, exposes women to new ways of thinking about the world and themselves; it delays them into marriage and childbearing. Education has an independant effect of either family income or husband's education on their fertility and on child survival chances. Normally their fertility is relatively lower and their child survival chances are greater than women without education 1/. The interpretation of these data need to be cautious because of small proposition of women ever attended formal education among these countries. It is known from recent education statistics that majority of females were illiterate in most of these countries. The percentage of females literate were 30, 63, 39, 14 and 37 respectively for Egypt, Morocco, Senegal, Sudan and Tunisia. It is only Morocco which had a majority of literate females of these countries. Estimates of literacy were not available for Mauritania2/. Where more women can read and write there are more children that survive to age five years. These children (of educated mothers) exhibit better levels of nutrition than do children of less educated and illiterate parents 3/.

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1) UN, "Interrelationships between child survival and fertility," in Population Bulletin of the United Nations, PP 27-47, New York 1988.

Table 17 presents estimates of children everborn, according to level of education attained and child loss experience of women interviewed. Child loss experience is understood in terms of whether a woman lost 1, 2, 3 and 4 children or never lost child (0). Figure 7 presents illustrations in form of histograms for these data. Education variable is divideds into four categories i.e. No education, Primary incomplete, Primary completed and Secondary and Higher.

In examining the combined influence of education, mortality and fertility is clearly demonstrated here. In the case of Egypt, for instance, influence of education appears to be minimal in being a factor that acts as a depressant on fertility. However, it is clear that experience of child loss or child mortality is a greater factor of fertility for all levels of education. Women who did not complete primary school education and lost at least two children have much higher fertility than their counterparts with no education or have had higher levels of education. The position is slightly different in the case of Mauritania. There, women with no education and have experienced child loss have consistently much higher fertility than those with education. However women who completed primary school and have lost many children experience highest fertility among them all. In Morocco on the other hand the situation is that women who had some education that did not complete their primary school level and experienced child loss appear to have lower levels of fertility than those without education and those that completed primary school level of education.

In Senegal lack of education and experience of child mortality are major determinants of fertility because it is them who have higher levels of fertility compared to those who received education. In Sudan the influence of education is noticed only for women who completed primary level of education as they have lower levels of fertility for all experiences of child mortality than women with no education or did not complete primary school. In Tunisia the influence of education appears to be very strong because women with education have much lower fertility and child mortality experience than those who did not go to school.

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1) Katrina et al, Child Survival: Risks and the Road to to Health - USA 1987.

2) Jeanne S. Newman, Women of the World: Sub-Sahara Africa PP 51-52, U.S. Bureau of the Census, Washington 1984.

3) UNICEF, The State of the World Children 1988, New York, 1989.

Table 17: Estimates of average number of children everborn according to child loss experience (CHD) and level of education

Country	CHD	No Education	Primary INCO	Primary COMP.	Secondary OVER
EGYPT					
	0	2.6	2.6	2.4	1.8
	1	4.7	4.6	4.5	3.7
	2	6.1	6.8	6.2	5.3
	3	7.2	7.7	7.5	5.8
	4	9.4	9.4	9.4	8.8
MAURITANIA					
	0	2.5	2.6	2.2	1.5
	1	4.6	4.5	4.4	3.0
	2	6.1	6.3	6.8	-
	3	7.6	7.3	7.0	-
	4	9.5	9.3	12.0	-
MOROCCO					
	0	2.0	1.2	1.2	0.4
	1	5.6	4.9	4.6	4.4
	2	7.0	5.9	7.5	7.3
	3	8.2	7.8	10.7	-
	4	10.3	-	9.0	-
SENEGAL					
	0	1.8	1.9	1.3	0.8
	1	4.4	4.7	4.1	2.7
	2	5.7	4.0	5.2	-
	3	6.9	-	6.5	-
	4	8.7	-	-	-
SUDAN					
	0	3.3	3.1	2.5	2.2
	1	5.3	4.4	4.9	3.8
	2	6.6	5.8	6.4	5.3
	3	7.8	6.5	4.0	-
	4	8.6	9.7	8.3	-
TUNISIA					
	0	3.7	2.9	2.1	2.7
	1	5.7	5.2	4.2	4.6
	2	7.4	6.3	6.4	-
	3	8.1	-	-	-
	4	9.2	-	-	-

In conclusion therefore, the relationship existing between child mortality and fertility is that generally fertility is higher where women lost a child or so in all countries perhaps in order to ensure that children dead are replaced or as insurance against anticipated child deaths. In high mortality countries like these, average number of children everborn tends to be quite high. Women without education and have had child loss experience appear to have much increased

fertility than those who attained a certain level of education in all countries. Women who had Primary education but did not Complete and have had child loss experiences appear to have similar fertility-mortality responses as those with no education. The exceptions may be those of Senegal and Sudan where the fertility-mortality responses are lower than for those without education. Perhaps this points to greater influence education has in those apparently higher mortality countries. Women who had attained and completed primary school and if those with secondary and higher education are considered together, (because of smaller number of women with Secondary and Higher education in all these countries) then it is quite clear that child mortality-fertility responses are relatively lower than for less educated women even if child loss experience is held constant. This reluctance to respond quickly to the mortality-fertility relationship may be that child survival is greater among educated than less educated women, hence there might be reduced urge to replace children dead or hold as insurance large number of births for anticipated child deaths in future. The estimates of coefficients of determination presented in Table 20 re-inforce these inferences. However as a statistic of predicting accuracy and strength of linear relationship the influence of education on fertility and mortality cannot be easily measured.

b) Birth intervals

In analysing the influence of birth intervals it has been observed that shorter birth intervals of less than two years and very long ones of greater than 36 months are all associated with higher estimates of fertility and child mortality. In examining the influence of birth intervals here, the purpose is to identify the responses exerted on child mortality-fertility interrelationship. That is the way women would respond to either fertility or mortality in the event that child loss experience is associated with birth intervals.

Table 18 presents data on number of children everborn according to child loss experience and length of birth intervals for each of the countries.

Table 18: Estimates of average number of children everborn according to child loss experience (CHD) and length of birth intervals

Country	CHD	Lengths of Birth Intervals				
		<12	12-23	24-35	36-47	48 +
EGYPT	0	2.8	3.3	3.8	3.9	4.0
	1	3.7	4.2	5.0	5.0	5.1
	2	5.7	5.6	6.3	6.7	6.3
	3	7.2	7.3	7.5	7.3	7.2
	4	8.9	9.6	9.3	9.2	9.2
MAURITANIA	0	4.0	4.1	3.8	3.8	3.7
	1	5.4	4.9	4.9	4.9	4.6
	2	6.9	5.8	6.3	6.6	5.9
	3	7.9	7.0	7.6	7.6	7.2
	4	10.5	9.3	9.5	8.8	9.5
MOROCCO	0	3.8	4.0	4.7	4.5	4.4
	1	6.3	5.1	5.8	6.3	6.3
	2	7.5	6.8	7.1	6.8	7.2
	3	7.6	7.9	8.4	8.5	8.4
	4	10.2	10.1	10.5	10.4	10.2
SENEGAL	0	4.3	3.5	3.8	3.8	3.4
	1	3.4	4.2	5.1	4.9	4.6
	2	4.3	5.3	5.8	5.7	5.5
	3	-	7.0	7.1	6.4	7.2
	4	-	9.0	9.0	8.4	8.3
SUDAN	0	4.9	4.2	4.5	4.5	4.4
	1	5.5	5.4	5.4	5.5	5.1
	2	6.1	6.2	6.9	6.2	6.4
	3	9.8	8.0	7.7	7.7	6.9
	4	-	8.2	9.5	8.8	7.6
TUNISIA	0	4.2	4.1	4.5	4.6	4.6
	1	4.7	5.2	5.0	5.4	6.2
	2	6.7	7.1	7.4	7.6	7.1
	3	8.3	8.1	8.3	8.3	7.7
	4	10.4	10.1	9.7	9.8	9.0

The information in Table 18 above suggests that average number of children everborn increases as number of children dead rises in all these countries. At the same time, for each

birth interval length the tempo of increase varies between different birth intervals. The relative increments are greater for shorter and very long birth intervals, than for the intermediate birth interval of length between 24 to 35 months.

In examining the influence of length of birth interval and experience of child loss it can be observed for women without experience of child loss average number of children everborn increases gradually as the length of birth interval increases in all the countries except for Mauritania, Senegal and Sudan. The data, for Senegal and Sudan appear to be erratic and therefore the results quality may be unreliable.

There is an interesting observation of the pattern of fertility relationship for women who experienced child loss. There is an apparent concave parabolic shape which shows a peak in the average number of children overborn for birth interval of less than 12 months and 48 + months for any number of child loss experience in all the countries. The shape flattens as the number of children dead rises. The interesting result is that the minimum point in the curve falls around the intermediate birth interval length and where a woman lost only a couple of children. Hence it can be inferred that with reduced child mortality and increased birth interval length the average number of children everborn would be minimal. It should have been appropriate to investigate this further and more research should in future be encouraged to examine this relationship in more detail.

The values of R^2 presented in Table 20 suggest that appropriate birth intervals is 24-35 for Egypt, Senegal, Sudan and Tunisia and for the other two countries it is birth interval 12-23. It is in these intervals that relationship is strongest.

c) Age

Age of women is a very important physiological variable because it determines when childbearing starts and stops. Normally women become mothers from as early as 15 years and may continue to have children until they reach their menopause which falls after 50 years. In demographic analysis childbearing is assumed to commence in the 15-19 age group and terminates in the 45-49 age group. According to studies on patterns of fertility birth history data show that peak fertility falls withim ages ranging from about 20 to 29 years. This period, extended a little further up to age 35 comprises the central childbearing age groups ie. are 20-24, 25-29 and 30-34. It is also known that reports of number of children everborn or surviving are less reliable for younger women in the age group 15-19 because of sampling variation, and for older women of 35 years or more, since such women may tend to forget to report correctly about their birth history information 1/.

1/ Brass, The Demography of Tropical Africa, PP. 88 - 114, Princetown University Press, 1968.

- Methods for Estimating Fertility and Mortality From Limited and Defective Data, PP. 11-17, 36-58. The University of North Carolina at Chapel, 1975.

Table 19: Estimates of average number of children everborn classified by child loss experience and age of women

Country	CHD	Age Group of Women						
		15-19	20-24	25-29	30-34	35-39	40-44	45-49
EGYPT	0	0.5	1.4	2.3	3.3	3.9	4.2	4.1
	1	1.7	2.6	3.8	4.9	5.7	6.1	5.9
	2	3.1	3.7	4.9	6.0	6.7	7.2	7.2
	3	-	4.1	5.8	6.8	7.8	7.8	8.1
	4	-	5.7	6.6	8.3	9.3	9.7	10.1
MAURITANIA	0	0.8	1.8	2.8	3.9	4.5	3.6	3.6
	1	1.9	2.8	4.2	5.4	5.6	6.2	5.9
	2	3.8	4.2	5.3	6.3	7.2	6.8	6.8
	3	-	5.3	6.7	7.7	7.2	8.3	7.9
	4	-	6.6	7.4	9.0	9.9	9.6	10.0
MOROCCO	0	0.1	0.9	2.1	3.7	4.4	4.9	4.3
	1	2.0	2.9	4.1	5.4	6.9	7.4	7.3
	2	3.5	4.3	4.9	6.8	7.2	7.8	8.1
	3	-	4.0	6.2	7.1	8.4	9.4	8.9
	4	-	-	7.7	9.3	9.6	10.6	10.9
SENEGAL	0	0.3	1.3	2.4	3.9	3.7	4.3	3.9
	1	1.4	2.5	3.8	5.4	5.5	5.9	6.4
	2	2.4	3.3	4.4	5.7	6.8	6.7	7.1
	3	-	3.6	5.4	6.5	7.6	7.5	8.1
	4	-	-	6.6	7.6	8.2	9.4	9.6
SUDAN	0	0.6	1.8	2.9	4.0	4.8	4.5	4.7
	1	1.7	2.9	4.2	5.7	6.6	6.9	6.3
	2	-	4.1	4.8	6.3	7.0	7.5	8.0
	3	-	5.5	6.1	8.0	8.1	7.8	8.1
	4	-	4.8	8.3	8.4	8.9	8.8	9.2
TUNISIA	0	0.6	1.4	2.5	3.7	4.7	5.3	5.2
	1	2.7	2.6	3.7	5.4	6.4	6.3	6.9
	2	-	3.7	5.0	6.3	7.5	7.9	8.2
	3	-	-	5.2	7.2	8.1	8.6	9.0
	4	-	-	-	8.3	9.9	9.8	10.2

Given these limitations and assumption that information given by women in central childbeering age groups is more reliable, it is necessary that reports of data being examined here should be interpreted with care.

In this analysis it is expected that older women would have more children everborn also would have more child loss experience, because they would have been exposed for much longer period to the risks of childbearing and child mortality. The fertility-mortality relationship being examined here is intented to analyse the influence of child loss experience and maternal age. Table 19 presents estimates of average number of children overborn for child loss experience and maternal age.

It can be observed that in all the countries, average number of children everborn increases as age of women advances and this is independent of child loss experiences. However, the increments observed vary significantly among the different countries, because of differences in the prevailing fertility and mortality patterns of these countries.

The child loss experience and maternal age exert influence on fertility-mortality relationship in several ways. Firstly, women who had not experienced any child loss appear to have their average number of children everborn to increase monotonically by age of women in all the countries except for Mauritania, Senegal and Sudan. This may be due to quality of data rather than revealing an existing pattern. Futhermore, the pattern first appear to be erratic in the older age groups of 35-39 for Mauritania, 40-44 for Sudan and 45-49 for Senegal. Information on reported by older women is suspected and therefore the observed pattern may be the result of data being less reliable. Secondly, for women who experienced child loss it can be deduced from this table that child loss appears to exert pressure on the fertility-mortality relationship, with combined effect of age of mother. The average number of children everborn increases by age of mother and the tempo increases much more if more children are dead than where there was no child loss, for all the countries. For example women aged 20-24 in Egypt their fertility increased by 85 per cent for women who lost one child, it was more than 160 per cent for losing a secong child. In Mauritania, this was about 55% and more than 130 per cent for losing one or the second child. This child loss experience tends to exert pressure on the fertility-mortality relationship and that its force varies significantly from one age group and country to the other. Further studies that would analyse this in greater detail would facilitate understanding of this complex relationship and formulation of policies to stem the high levels of fertility and child mortality in the countries concerned. Estimates presented in Table 20 reiterate the conclusion that maternal age is a strong determinant of fertility and mortality, particularly in the case of Egypt, Senegal and Tunisia. Its influence is much less so in Morocco and Sudan. Since coefficients of determination measure on linear relations,it is not possible to explain reasons for age having less influence on mortality and fertility in Morocco and Sudan.

Table 20 : Coefficients of determination between child mortality and fertility by birth interval, age and education of mother

Country	I in Interval			Education				Age
	<12	12-23	24-35	None	Primary Inc.	Primary Conc.	Sec+	
EGYPT	-	.8008	.8975	.9871	.9831	.9945	.9576	.9240
MAURITANIA	.4366	.8229	.7944	.9561	.9911	.9214	-	.6403
MOROCCO	.7577	.8084	.5865	.9558	.9369	.8328	.9999	.0224
SENEGAL	.4123	.6369	.7336	.9791	-	.9494		.7346
SUDAN	.0494	.5122	.7475	.9735	.9401	.5763	.9970	.0054
TUNISIA	.6373	.8950	.9266	.9639	.9691	.9958	-	.7346

V. SUMMARY AND CONCLUSION

This study has contributed to the knowledge that estimates of mortality and fertility still remain to be quite high in the whole continent of Africa, and this includes the six countries included in this analysis. This high levels of fertility and mortality, are seemingly responsible for relatively high child mortality among young children under five years of age.

The major determinants of high fertility and mortality in Africa are complex and varied in terms of their influence as covariates of fertility and mortality and to facilitate interpretation of implied inferences. Nonetheless it has been demonstrated in this study that among these many determinants education of the mother, their maternal age, birth spacing and suprisingly the demographic situation of fertility and mortality are in fact among the major ones which influence childbearing and child mortality in Africa. Women who are illiterate, old and bear children at close intervals are associated with high fertility and high child loss experience. Furthermore, most of these covariates are responsible for differentials observed between different sub-groups of population and among the countries. For example Morocco, Tunisia or Egypt which have more literate women have comparatively lower levels of fertility and child mortality than Senegal or Sudan.

The results from this analysis suggest that provision of some education to women in particular would influence the reduction of fertility and child mortality. Similarly efforts to encourage women to space childbearing by at least more than two years and not continue childbearing beyond 35 years of age would certainly contribute to reducing both fertility and mortality. If

child survival chances increase in African countries the two-way relationship of fertility and mortality would change from increasing number of children each woman would bear in order to hold as insurance against expected child deaths to that of desired surviving children. This would imply that development programmes to improve child care health, child spacing and illiteracy would be essential to reducing fertility and child mortality.

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A P P E N D I X

Fig. 1(a) : Average number of children everborn by age of women

Fig. 1(b) : Proportions of children surviving by age of women

Fig. 2 : Age patterns of fertility

Fig. 3 : Age patterns of child mortality

Fig. 4(a) : Age patterns of child mortality and marital status (Egypt)

Fig. 4(b) : Age patterns of child mortality and marital status (Mauritania)

Fig. 4(c) : Age patterns of child mortality and marital status (Senegal)

Fig. 4(d) : Age patterns of child mortality and marital status (Morocco)

Fig. 4(e) : Age patterns of child mortality and marital status (Sudan)

Fig. 4(f) : Age patterns of child mortality and marital status (Tunisia)

Fig. 5 : Completed fertility by marital status

Fig. 6 : Total fertility rates by marital status

Fig. 7(a) : Egypt child loss influence on fertility and level of education

Fig. 7(b) : Mauritania child loss influence on fertility and level of education

Fig. 7(c) : Morocco child loss influence on fertility and level of education

Fig. 7(d) : Senegal child loss influence on fertility and level of education

Fig. 7(e) : Sudan child loss influence on fertility and level of education

Fig. 7(f) : Tunisia child loss influence on fertility and level of education.

FIG 1(a): AVERAGE NUMBER OF CHILDREN

EVERBORN BY AGE OF WOMEN

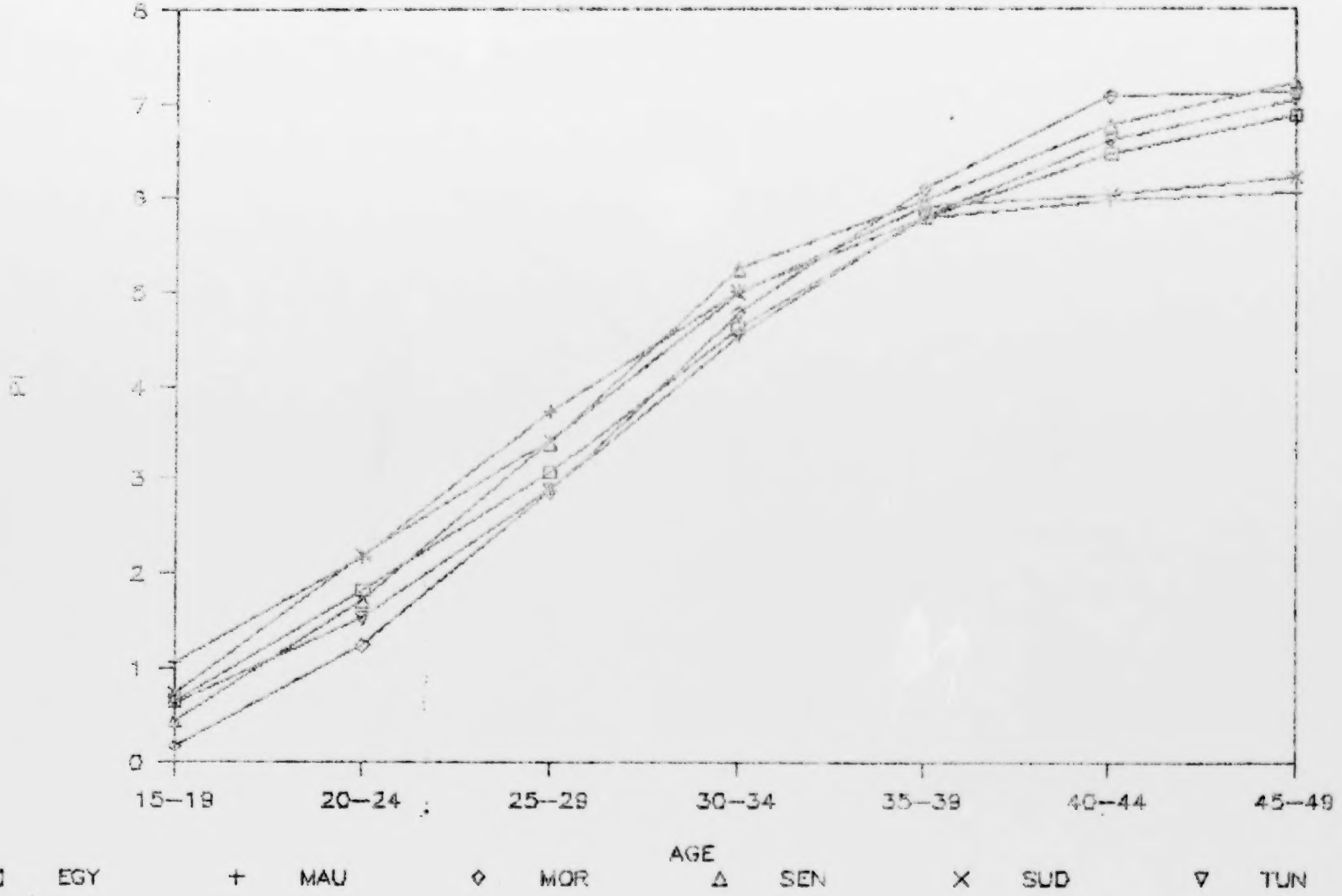

FIG 1(b): PROPORTIONS OF CHILDREN

SURVIVING BY AGE OF WOMEN

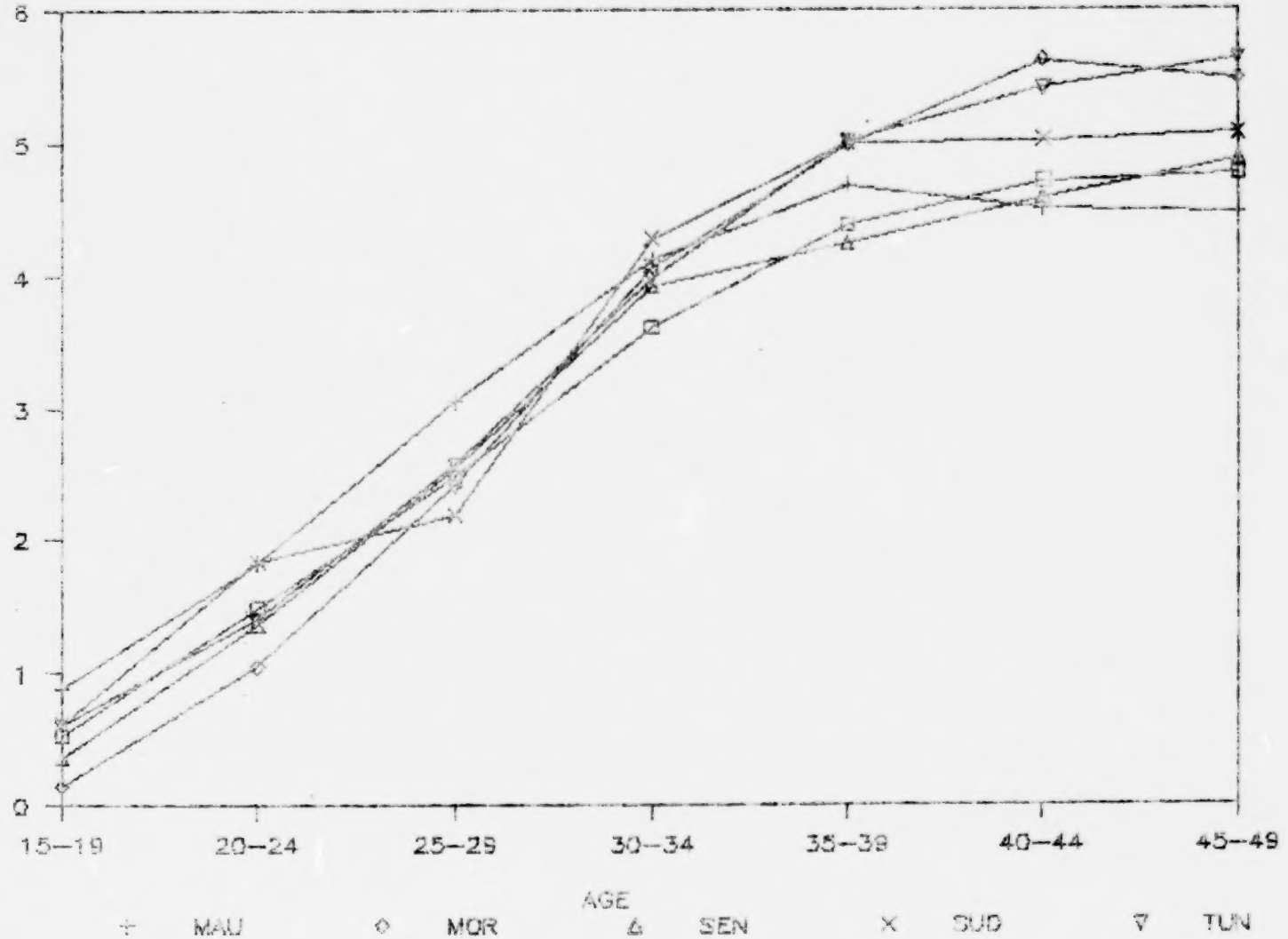

FIG 2: AGE PATTERNS OF FERTILITY

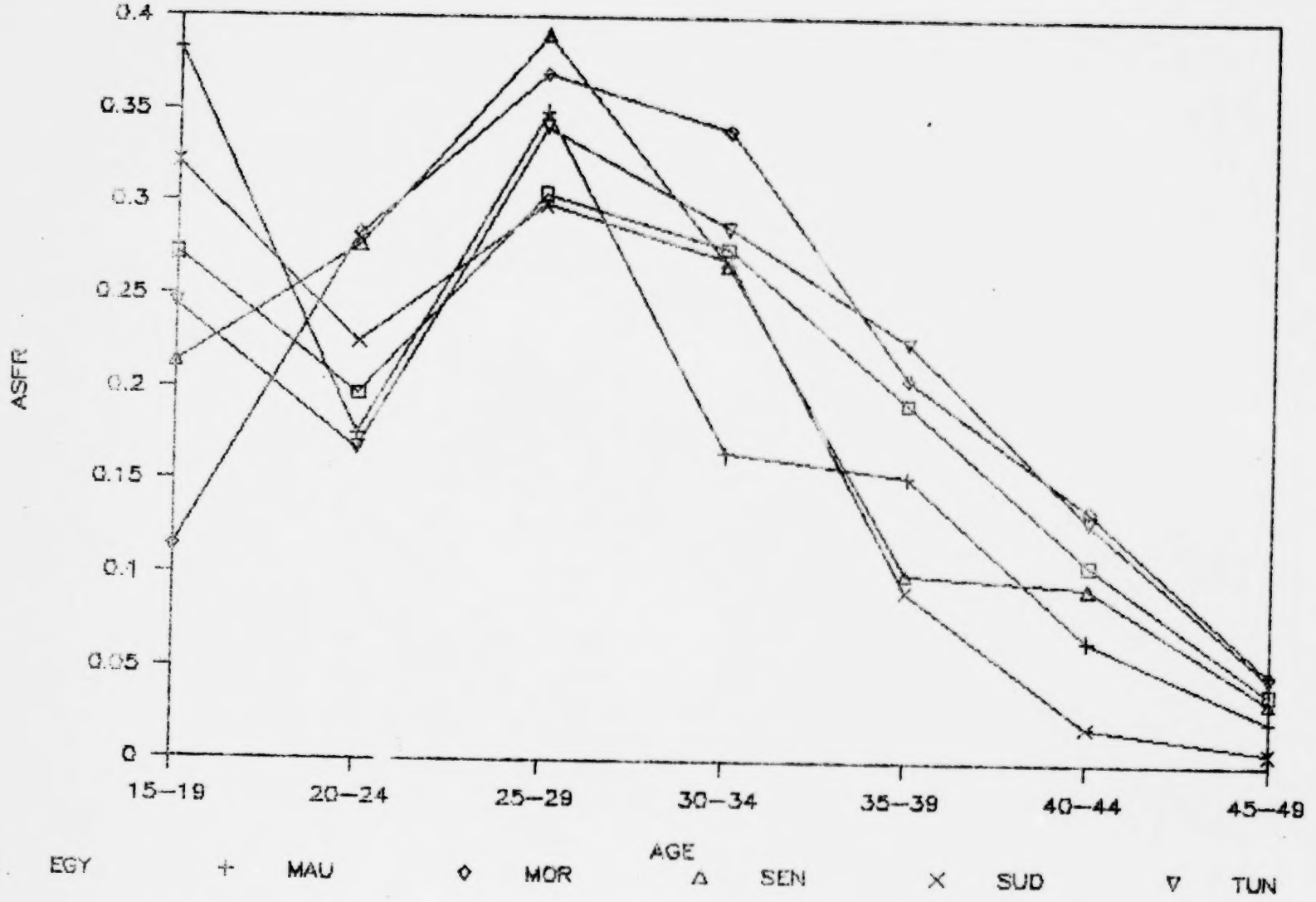

FIG 3: AGE PATTERNS OF CHILD MORTALITY

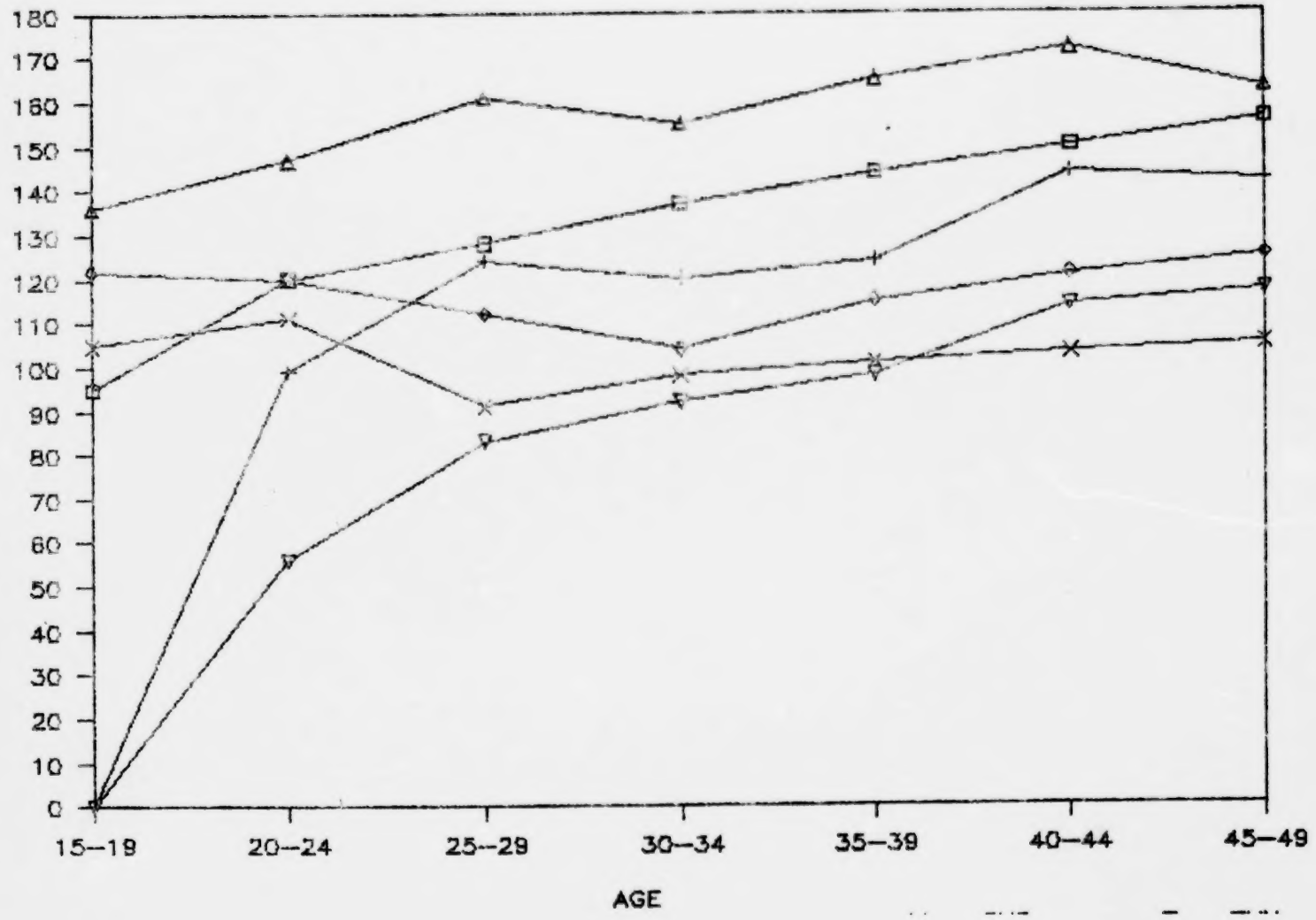

FIG 4A: AGE PATEERNS OF CHILD MORTALITY

AND MARITAL STATUS(EGYPT)

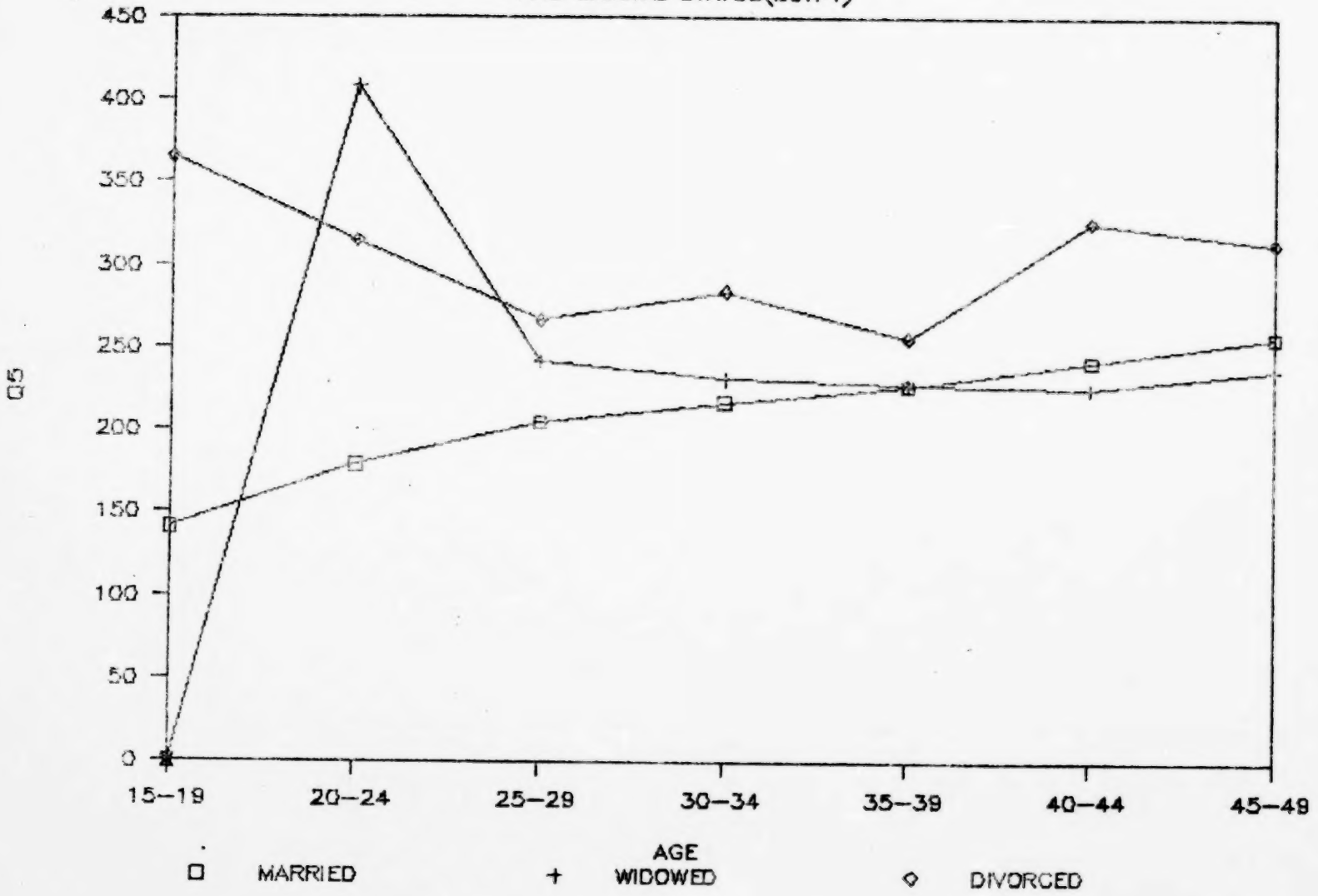

FIG 4B: AGE PATTERNS OF CHILD MORTALITY

AND MARITAL STATUS(MAURITANIA)

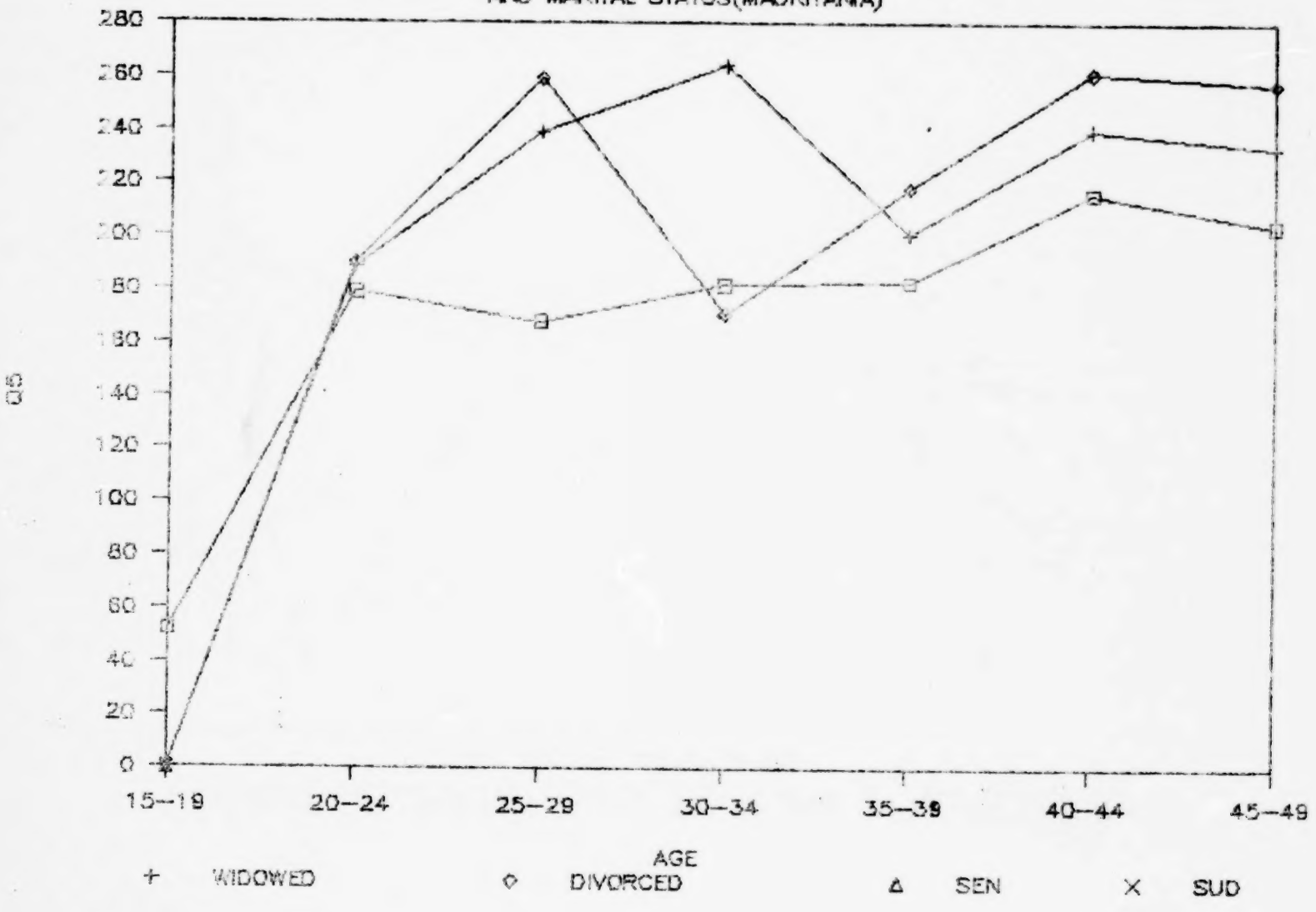

FIG 4C: AGE PATTERNS OF CHILD MORTALITY

AND MARITAL STATUS(SENEGAL)

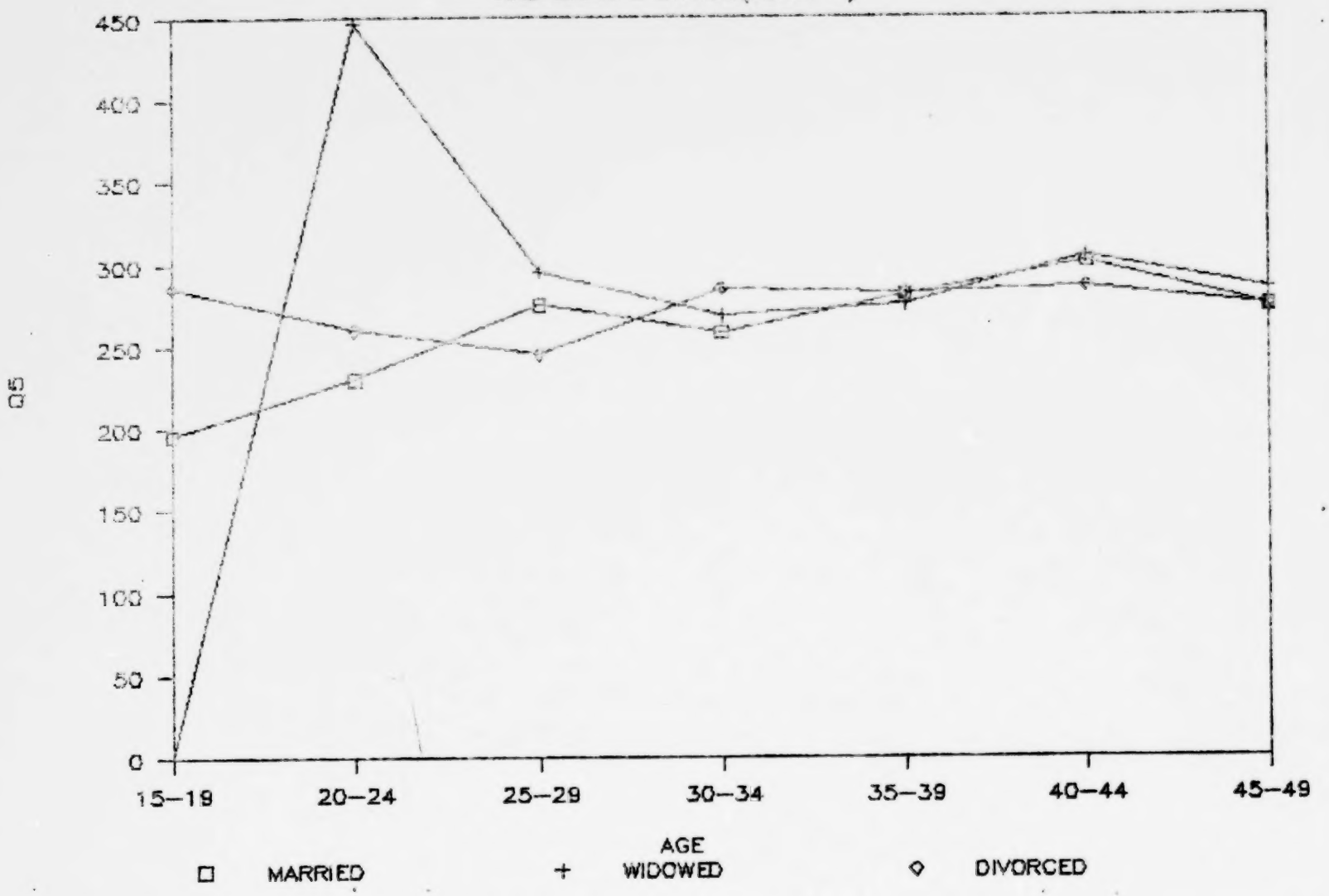

FIG4D:AGE PATTERNS OF CHILD MORTALITY

AND MARITAL STATUS(MOROCCO)

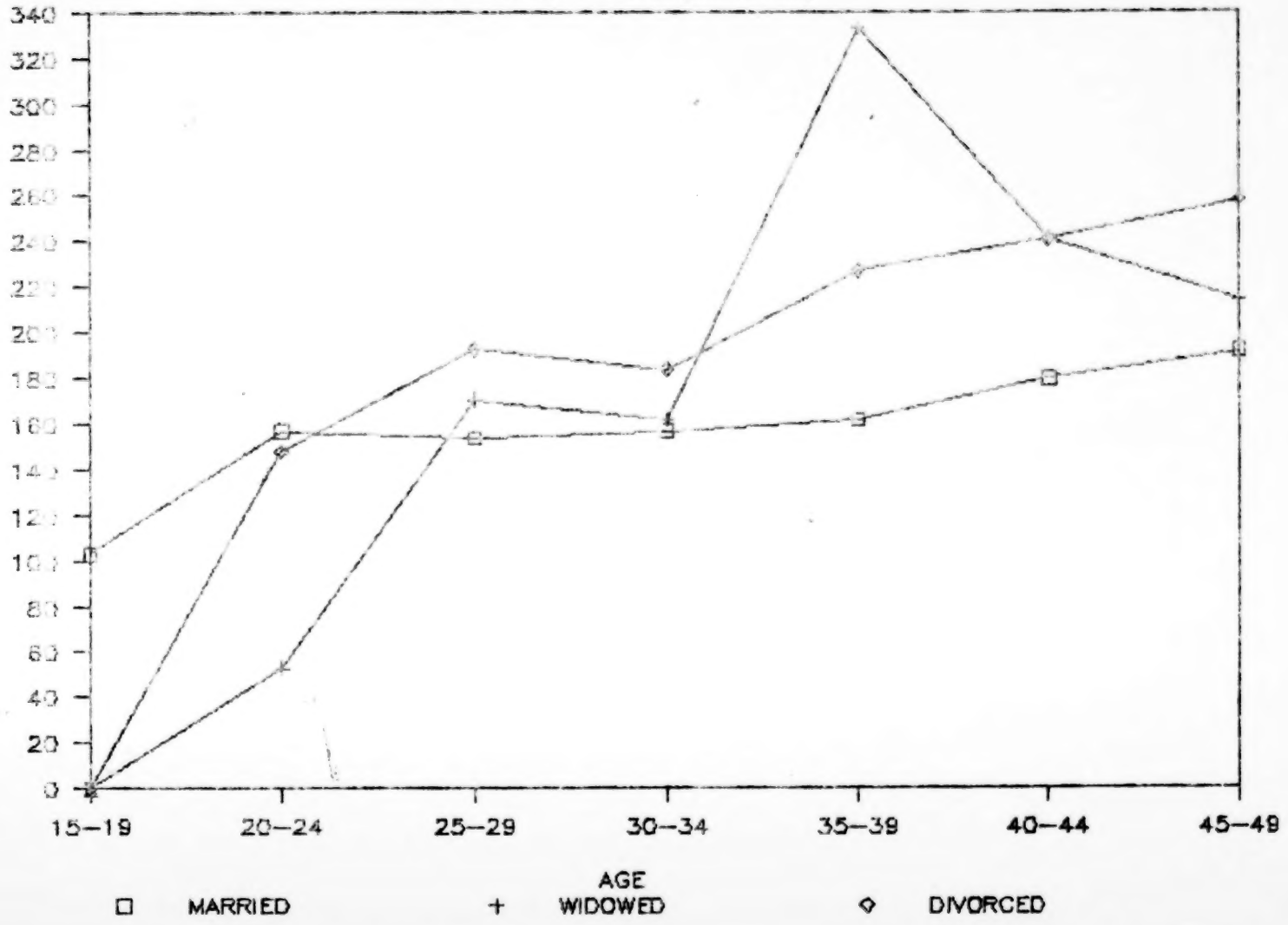

FIG4E:AGE PATTERNS OF CHILD MORTALITY

AND MARITAL STATUS(SUDAN)

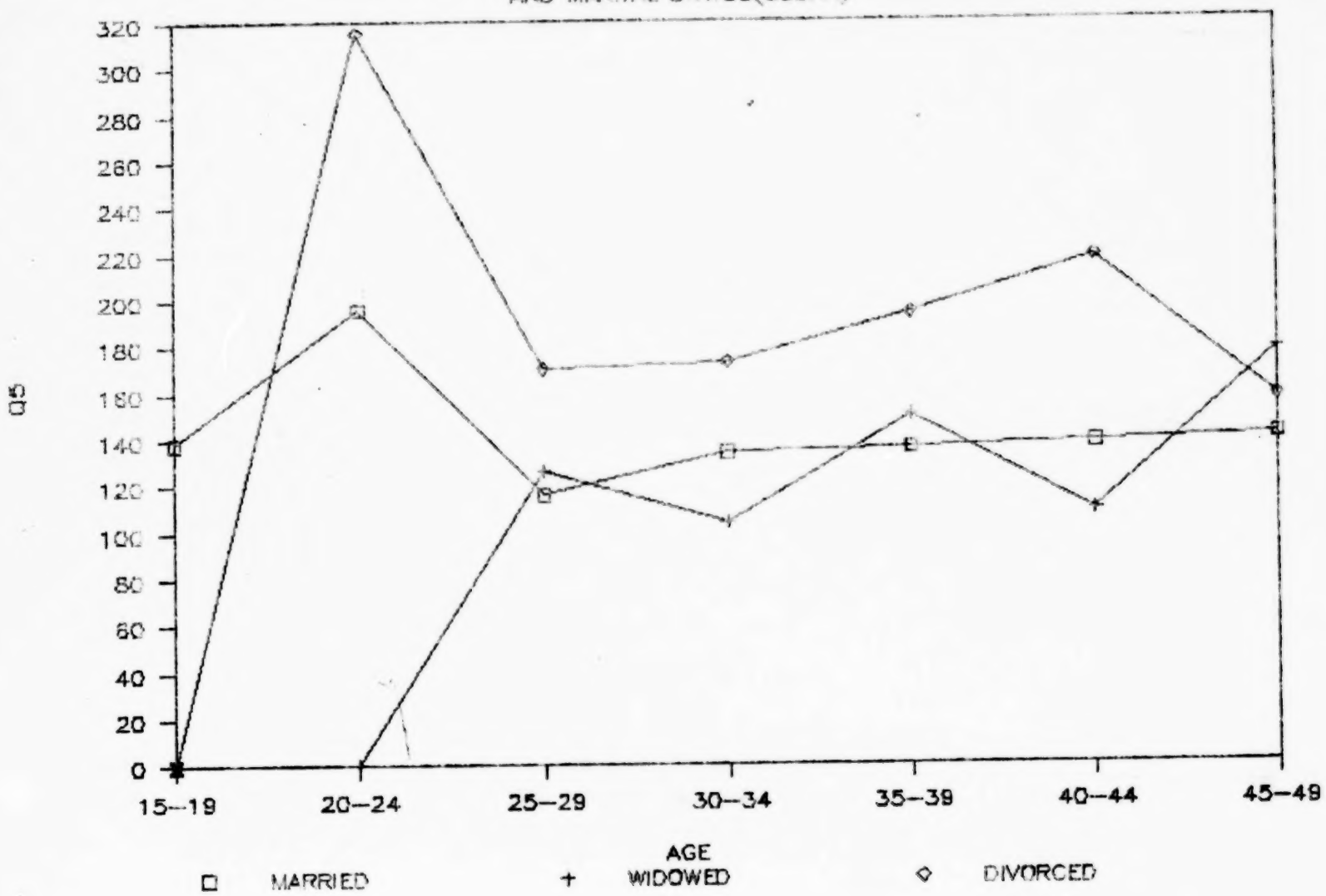

FIG4F:AGE PATTERNS OF CHILD MORTALITY

AND MARITAL STATUS(TUNISIA)

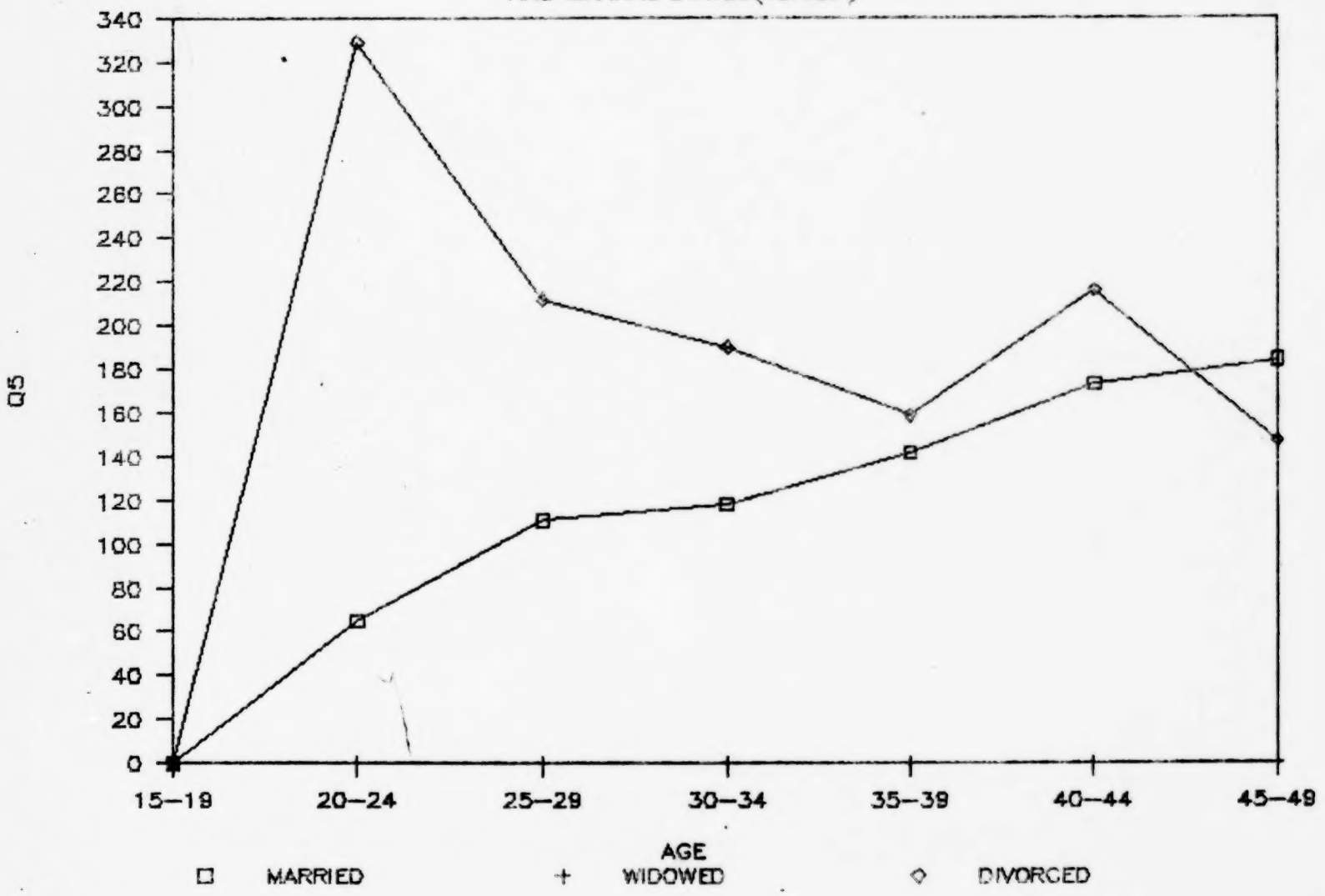

FIG 5 . COMPLETED FERTILITY BY MARITAL STATUS

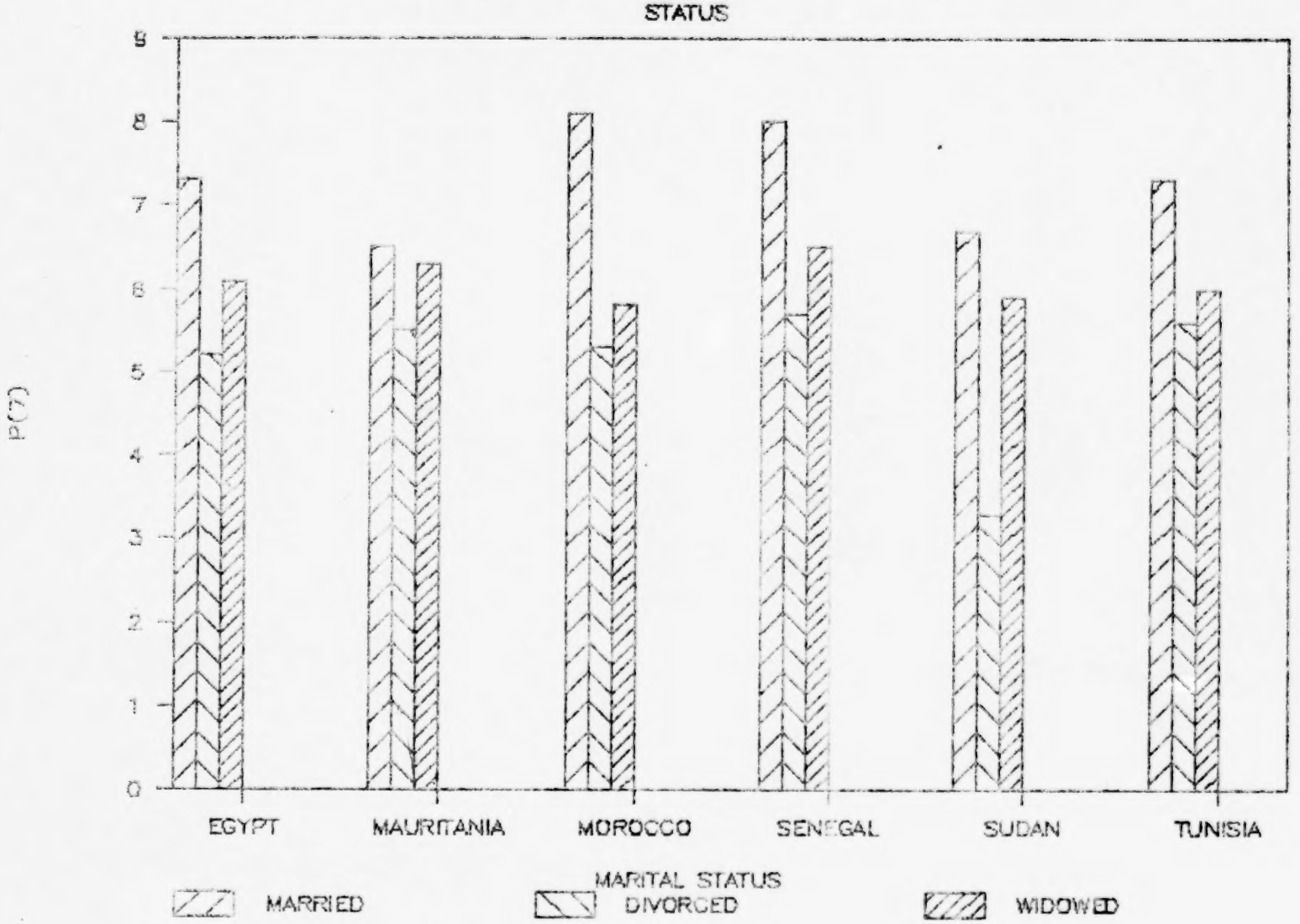

FIG 6: TOTAL FERTILITY RATES BY MARITAL STATUS

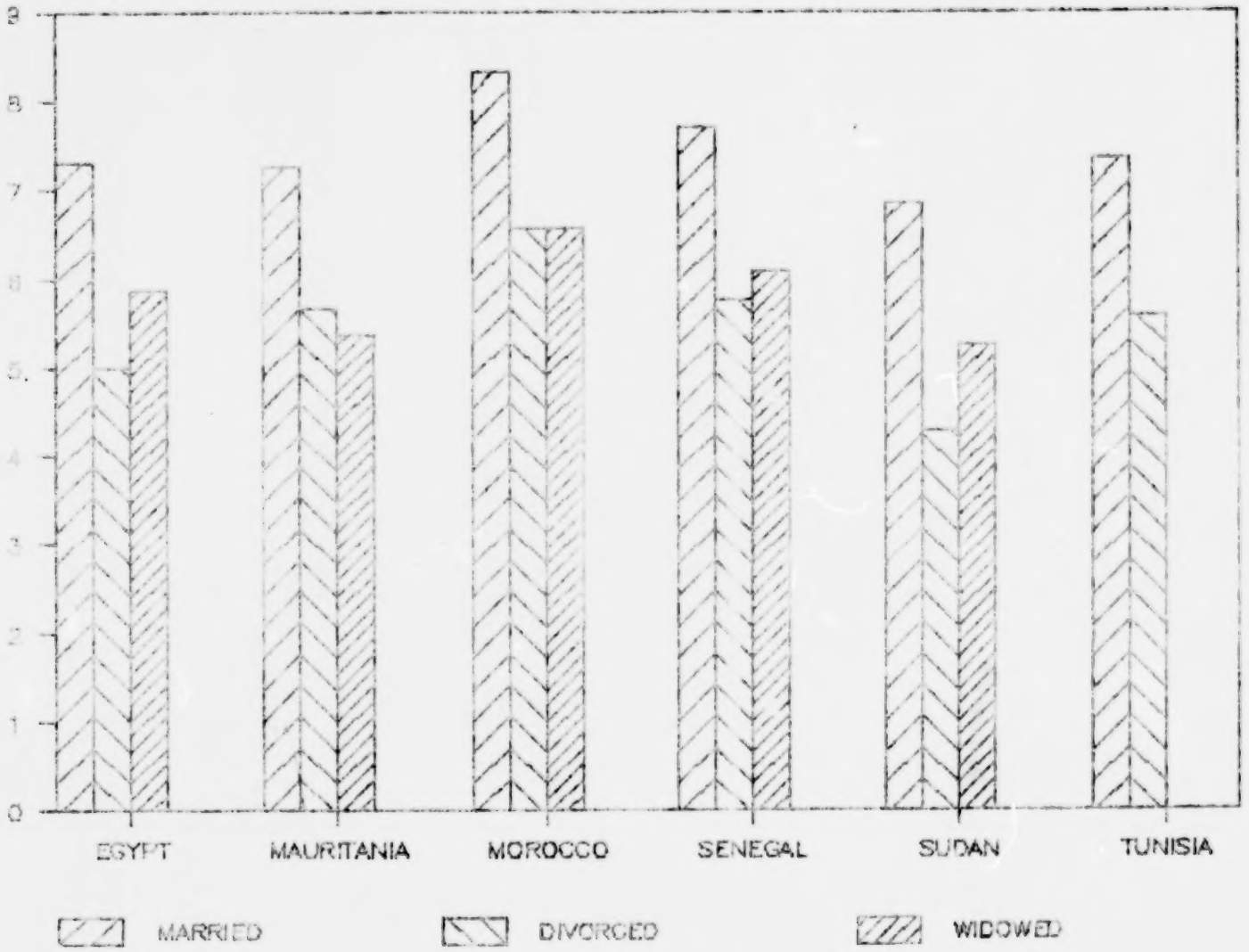

FIG 7A:EGYPT CHILDLOSS INFLUENCE

ON FERTILITY AND LEVEL OF EDUCATION

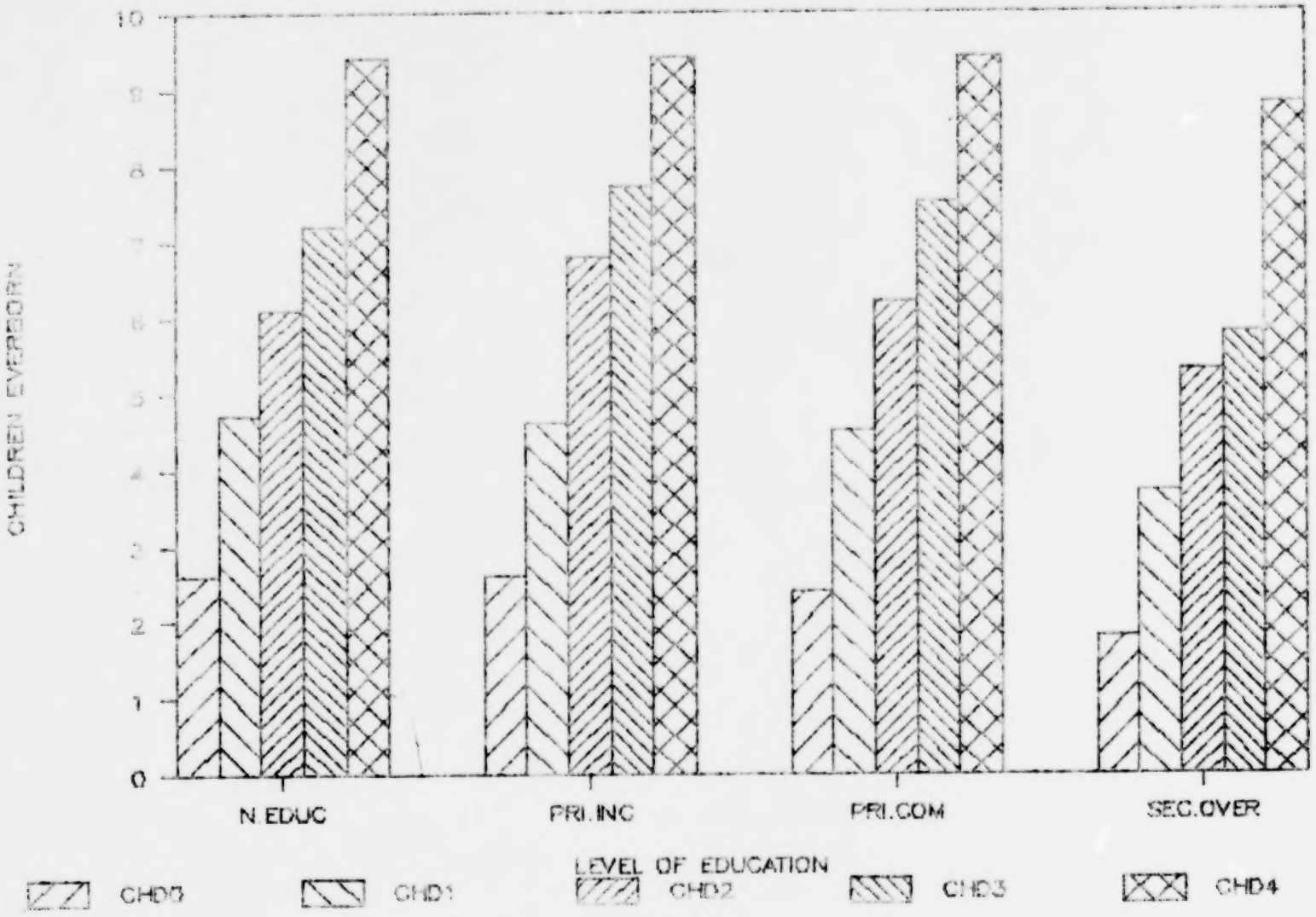

FIG 7B: MAURITANIA CHILDLOSS INFLUENCE

ON FERTILITY AND LEVEL OF EDUCATION

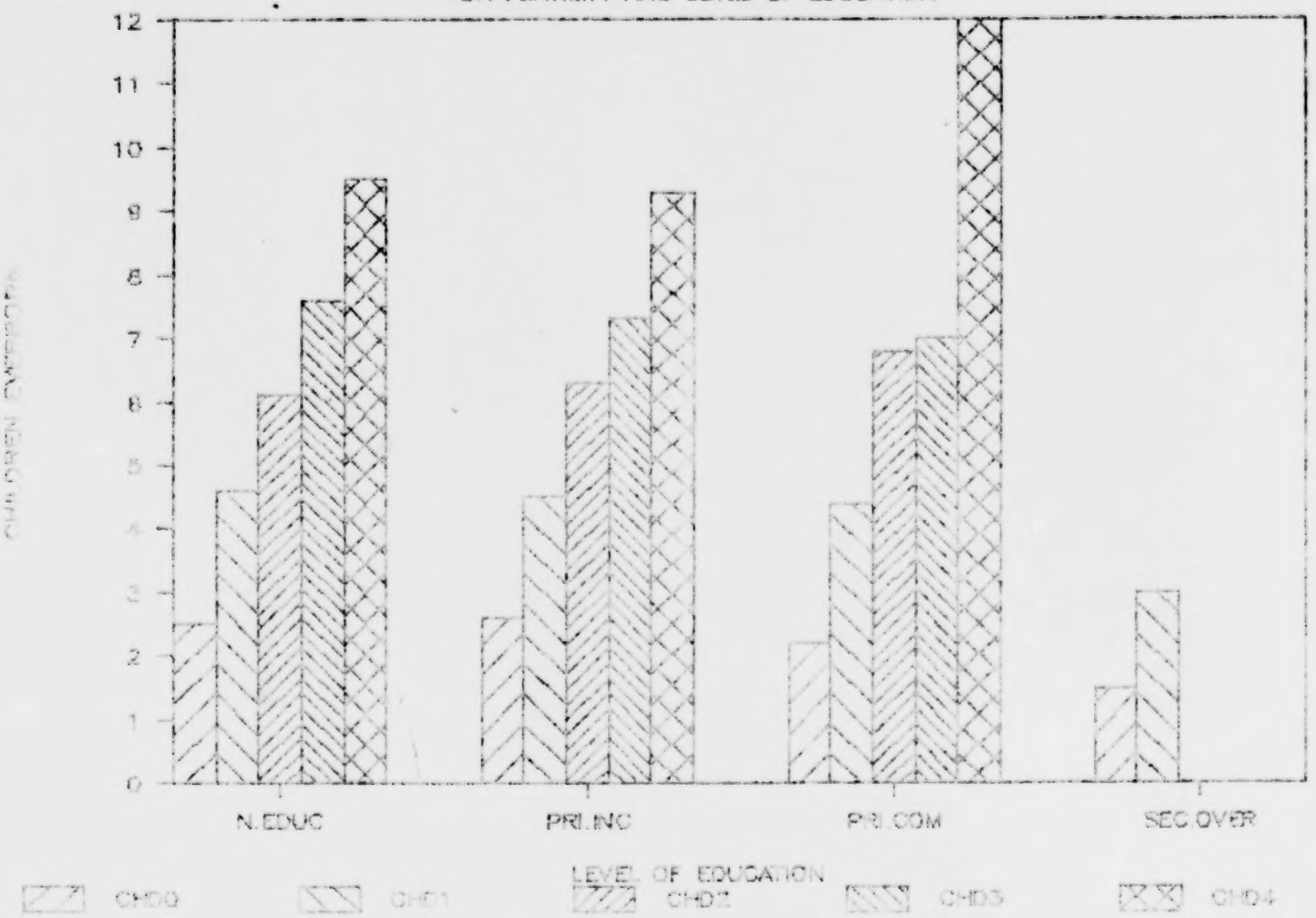

FIG 7C: MOROCCO CHILDLOSS INFLUENCE

ON FERTILITY AND LEVEL OF EDUCATION

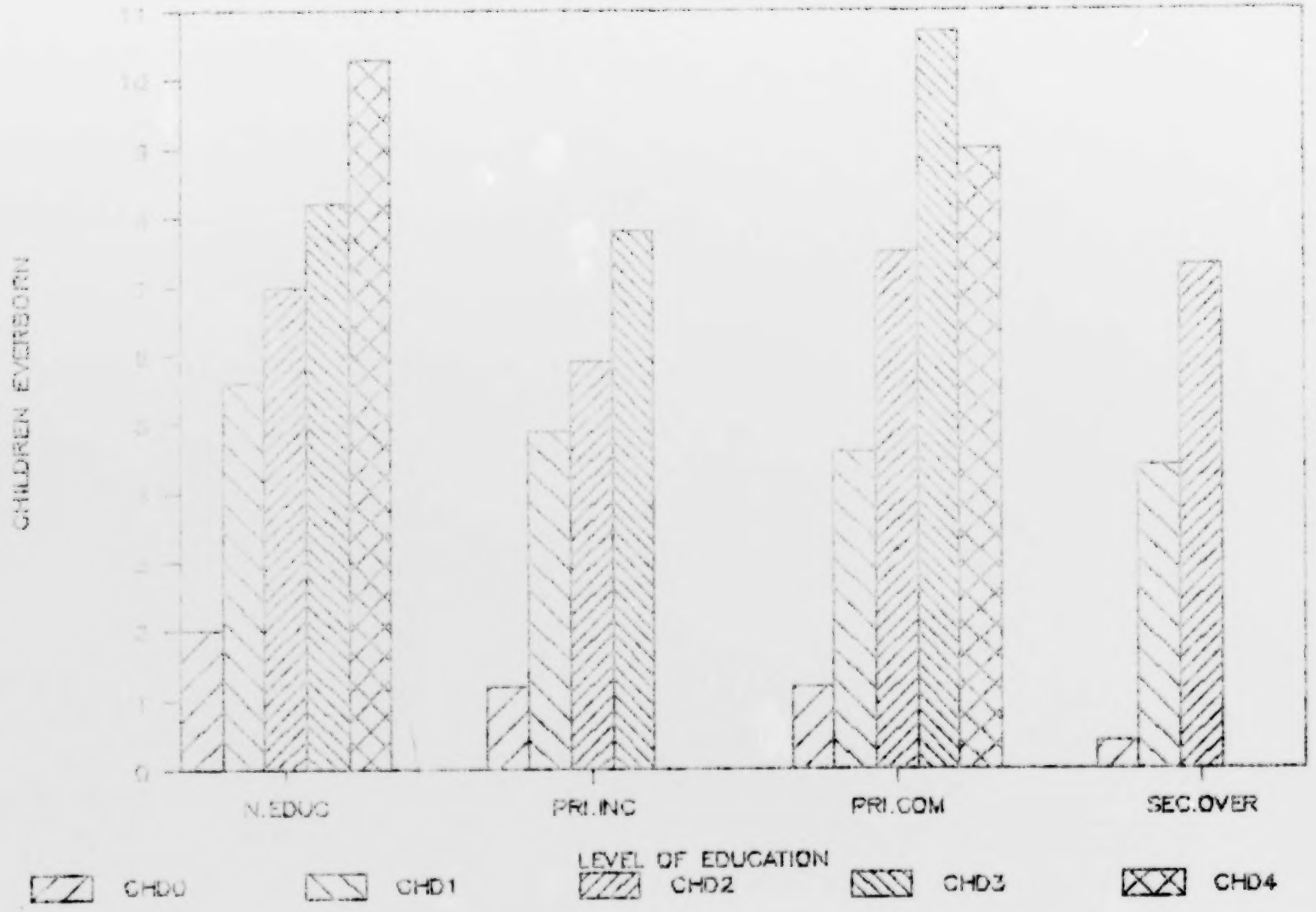

FIG 7D: SENEGAL CHILDLOSS INFLUENCE

ON FERTILITY AND LEVEL OF EDUCATION

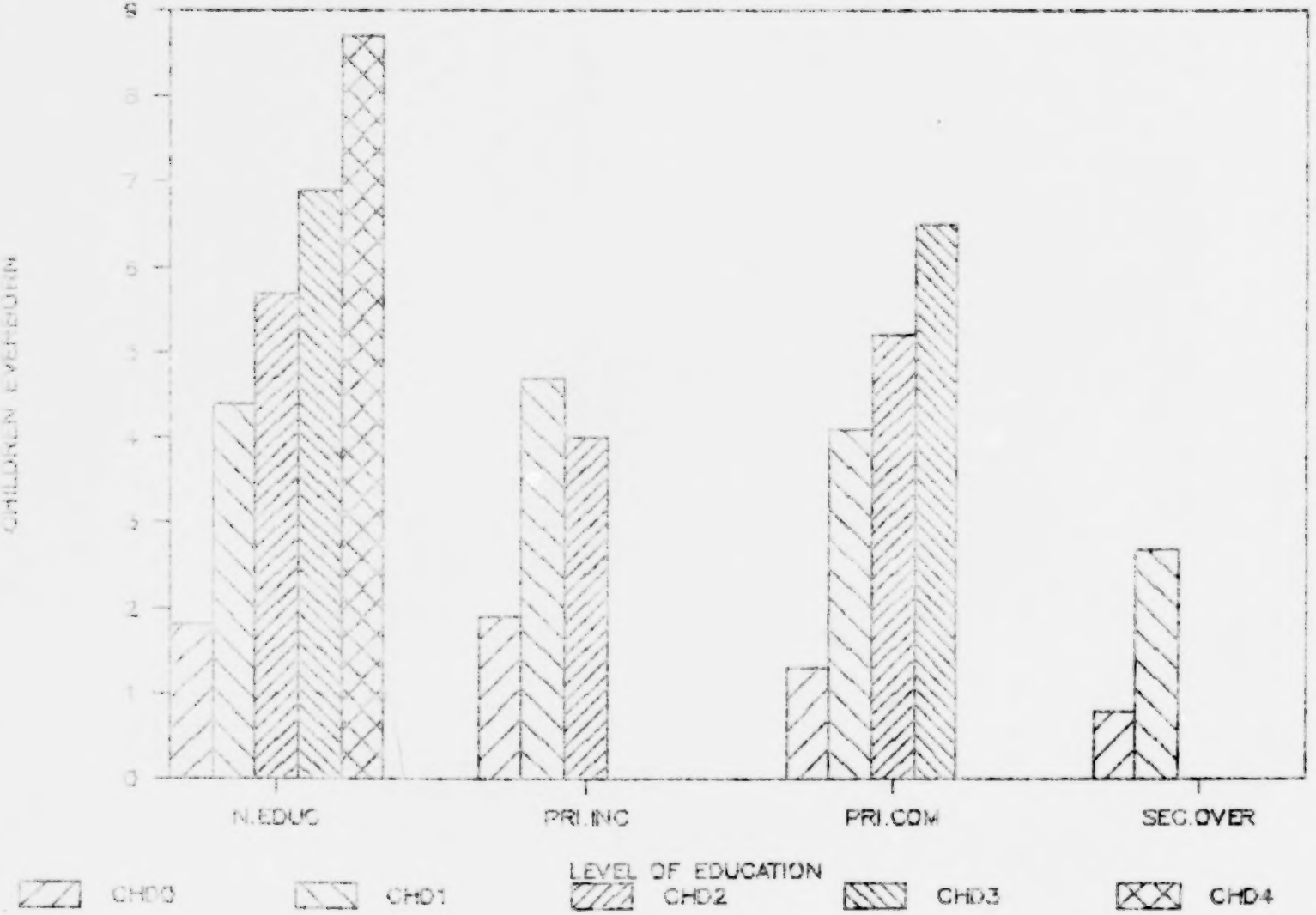

FIG 7E: SUDAN CHILDLOSS INFLUENCE

ON FERTILITY AND LEVEL OF EDUCATION

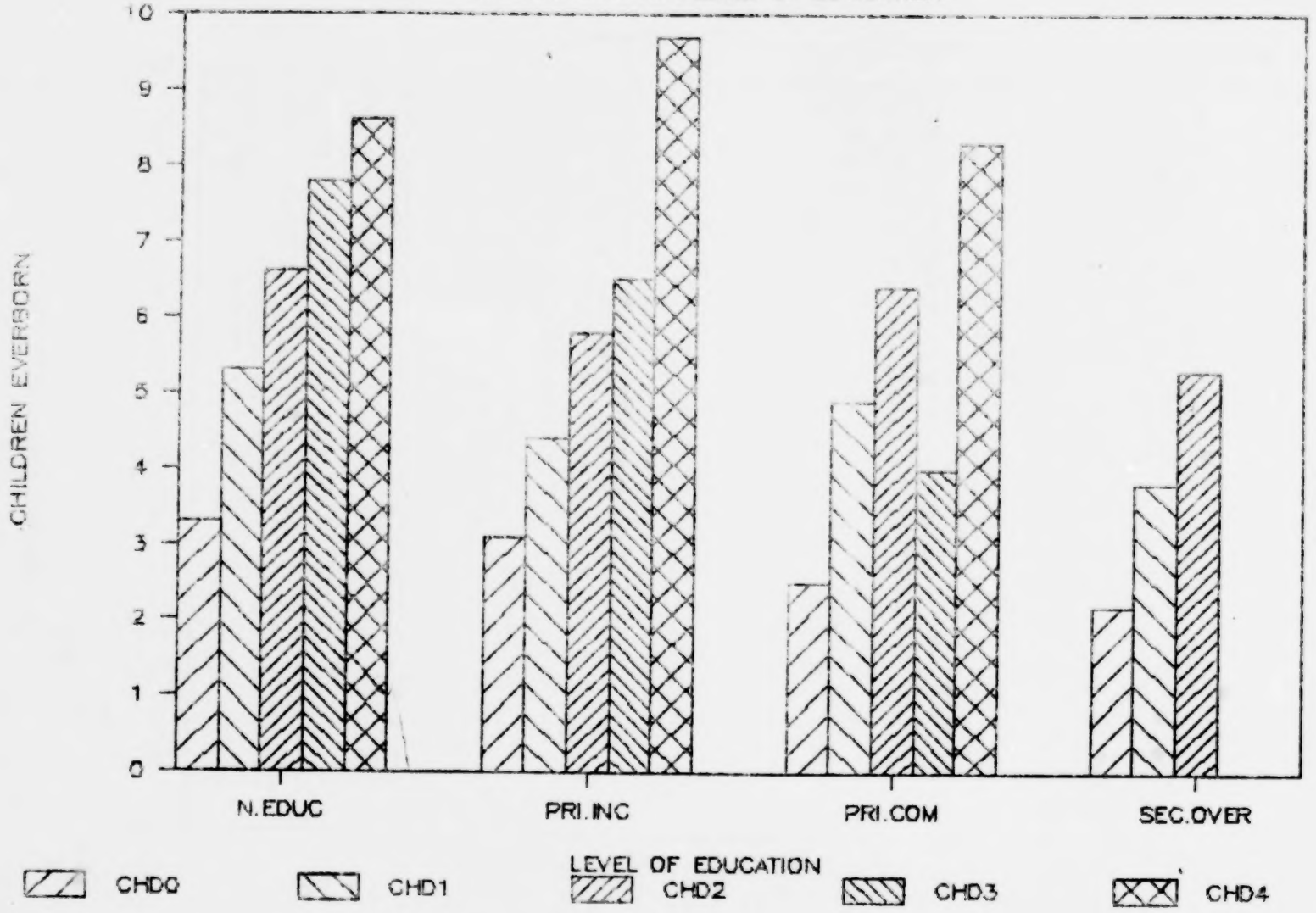

FIG 7F: TUNISIA CHILDLOSS INFLUENCE

ON FERTILITY AND LEVEL OF EDUCATION